Next Meeting, The American Association of Orthodontists, San Francisco, California, May 8 through 12, 1955. Headquarters, The Fairmount Hotel.

AMERICAN JOURNAL OF ORTHODONTICS

OFFICIAL PUBLICATION OF
THE AMERICAN ASSOCIATION OF ORTHODONTISTS,
ITS COMPONENT SOCIETIES, AND
THE AMERICAN BOARD OF ORTHODONTICS

UNIVERSITY OF MICHIGAN
OCT 7 1954
DENTISTRY LIBRARY
C 3

Editor-in-Chief

H. C. POLLOCK, ST. LOUIS, MO.

Assistant Editor

EARL E. SHEPARD, ST. LOUIS, MO.

Editor of Abstracts and Reviews

J. A. SALZMANN, NEW YORK, N. Y.

Sectional Editors

CHARLES R. BAKER, Evanston, Ill.
HENRY D. COSSITT, Toledo, Ohio
JOSEPH D. EBY, New York, N. Y.
WILLIAM E. FLESHER, Oklahoma City, Okla.
HENRY F. HOFFMAN, Denver, Colo.
STEPHEN C. HOPKINS, Washington, D. C.
JAMES D. McCOY, Beverly Hills, Calif.
OREN A. OLIVER, Nashville, Tenn.

PUBLISHED BY THE C. V. MOSBY COMPANY, ST. LOUIS 3, U. S. A.

TABLE OF CONTENTS ON PAGE 2

Copyright 1954 by The C. V. Mosby Company

Vol. 40 OCTOBER, 1954 No. 10

Whatever Your Needs. . .

1 Williams Round Buccal Tubes — for .036" or .040" diam. wire.

2 Williams No. 2 Arch Wire — for labial or lingual arches. Round (.036" to .040" diam.) or rectangular (.022" x .028").*

3 Williams No. 1 Ortho Wire — for intermaxillary hooks, adjustable spring stops, etc. (.020", .022", .036" or .040" diam. wire).*

4 Williams Anterior Bands — anatomically contoured — 18 graduated sizes, .004" x .160" wide.

5 Williams Open Bracket Tubes — for .032", .036", or .040" diam. wire.

6 Williams Stainless Steel Ligature Wire — .012" diam.

7 Williams Lok-Tite Wire — high bend test rating — .028" and .030" gages.

8 Williams Mershon Tubes and Posts — extra bearing surface for greater stability to lingual arch. (Also round and half-round tubes.*)

9 Williams Seamless Molar Bands — plain or contoured — 24 graduated sizes, .007" thick x .180" wide.

10 Williams Adjustaloop Contoured Bands — precise anatomical conformity — .036" to .485" diams.

11 Williams No. 1 Ortho Spring Wire — for stabilizers, auxiliary springs, etc. — .020" or .022" diam.*

12 Williams Arch Repair Tubes — slotted for quick, simple mending. In 4 sizes.

13 Williams Band Material — gages .009" to .003", widths .12" to .25".*

X Williams Ortho Wire Solder — gages .020" and .012" known for its ease of flow, strength, and absence of pitting.

*Items indicated also available in stainless steel.

Above is only a partial listing of Williams Orthodontic Materials.
For helpful information on all items write for complete catalog and prices.

WILLIAMS *Gold Refining Co.*, INC.

FORT ERIE ONT — BUFFALO 14, N Y — HAVANA CUBA

Vol. 40, No. 10, October, 1954. American Journal of Orthodontics is published monthly by The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo. Subscription price: United States and its possessions, $10.00; Canada, $10.25; Foreign, $11.00. Entered as Second-class matter, January 14, 1915, at the Post Office at St. Louis, Missouri, under the Act of March 3, 1879. Printed in the U. S. A.

American Journal
of
ORTHODONTICS
(All rights reserved)

VOL. 40 OCTOBER, 1954 NO. 10

Original Articles

SUBCONDYLAR FRACTURES OF THE MANDIBLE: RESEARCH AND TREATMENT

JOSEPH R. JARABAK, D.D.S., M.S.,* EAST CHICAGO, IND.

TODAY the automobile, in addition to being a necessary vehicle of transportation for business and pleasure, has become a conveyance for death and such injuries as skull, maxillary, and mandibular fractures. In many cases the occupant's chin is forced into the windshield or instrument panel with such force that either one or both of the mandibular condyles are snapped off at their necks. However, automobile accidents are not the only cause of subcondylar fractures. Accidents in the home in which children fall down a flight of stairs, from a scooter, or from a bed, as well as those encountered in play or cycling, are also responsible for many subcondylar fractures. An example of this is the 3½-year-old boy who, after a hard day of play in his sandbox, was bathed, fed, and put to sleep in his Hollywood bed whose mattress was 1½ feet from the floor. During the night, as the child rolled and twisted, he fell from his bed, striking the floor sharply with his chin and incurring a deep laceration. In response to his cries, the mother rushed into his room, picked him up, and comforted him, not realizing that he had sustained a subcondylar fracture. After bandaging his chin, she assured him that he would feel better in the morning. In a few days, however, a swelling occurred in front of his right ear, but still no significance was attached to this. A few days later the boy complained of pain in this area when he chewed or talked; he was taken immediately to the pediatrician, who ruled out the possibility of mumps and referred the child to a roentgenologist. Much to the amazement of the parents, a unilateral subcondylar fracture of the right side was revealed. This fracture was recognized soon enough to permit treatment, but frequently cases arising under similar cir-

Presented before the Great Lakes Society of Orthodontists in Grand Rapids, Mich., Nov. 4, 1953.

*Associate in Research, Northwestern University.

cumstances go unnoticed during the growth period of the child, resulting in facial asymmetries and dental malocclusions whose etiology remains unknown until the temporomandibular joint is radiographed and a healed fracture is recognized by the anteromedial position of the mandibular condyle.

There are some in attendance who have never seen or attempted to reduce a subcondylar fracture; others have helped their medical and dental conferees with a radiographic diagnosis; while still others have attempted to reduce subcondylar fractures with orthodontic appliances, only to find that, in certain cases, subsequent radiographs reveal that the mandibular condylar fragment remained displaced as far medially and anteriorly as before the start of the intermaxillary fixation. When this happens, we ask ourselves whether we actually are reducing the fracture and re-establishing a union to promote growth

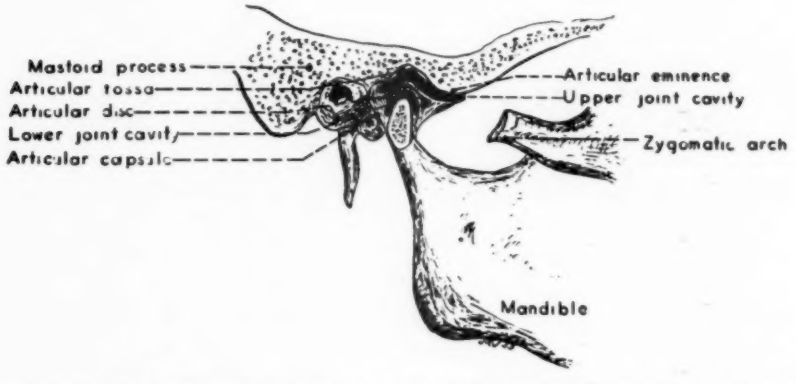


Fig. 1.—Temporomandibular joint showing the articular fossa, eminence, mandibular condyle, and articular capsule.

along the axes intended by Nature, or whether our efforts are only contributing to the creation of a dentofacial cripple. Since the orthodontist, in the eyes of his medical and dental colleagues, is a specialist in occlusion, growth, and development, his advice is sought concerning the reduction of subcondylar fractures, and he also may be asked to participate in the actual reduction. It is essential that his knowledge on the subject be kept abreast of the most recent findings of research.

To understand these findings more fully, we first must fix in our minds the outlines of the normal joint. This joint (Fig. 1) is composed of an articular fossa and the mandibular condyle; these bony parts are separated from each other by the articular disc. The fossa is located in the squama of the temporal bone anterior to the tympanic bone (Fig. 2, *A*, *B*, *C*, and *D*), the petrotympanic fissure being the posterior border of the fossa as well as the anterior border of the tympanic bone (Fig. 2, *B*). This fossa, on its posterior border, has a ridgelike elevation that serves as an abutment for the mandibular condyle in its most posterior excursion, making it literally impossible for the condyle to be displaced posteriorly onto the surface of the tympanic bone. In addition to the posterior border, the fossa has a lateral border which lies below

the posterior curvature of the zygomatic arch (Fig. 2, *D*) and a medial border that is bounded somewhat anteriorly by the angular process of the sphenoid bone (Fig. 2, *A*). The surface of the articular fossa is elliptical, wider on its lateral border and narrower medially; it is separated from the condyle by a thick, ovoid, fibrous articular disc. Anterior to the fossa along the inferior surface of the root of the zygomatic arch is a convex surface, the articular eminence. The fossa side of the temporomandibular joint, the disc, and the articular surface are covered by an envelope, the synovial capsule (Fig. 1), which is folded upon itself in such a manner that the upper half of the capsule is attached to the fossa surface of the temporal bone and the upper surface of the articular disc. The lower half surrounds the remainder of the disc and proceeds to the lower half of the joint, fanning downward laterally and medially to enclose the

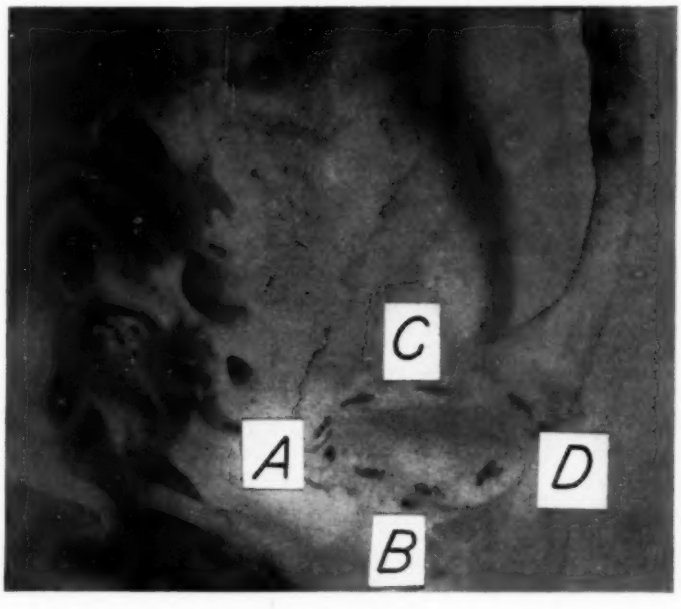


Fig. 2.—Boundaries of the articular fossa. *A*, Medial; *B*, posterior; *C*, anterior; *D*, lateral.

articular surface of the condyle as well as the upper portion of its neck. In addition to the synovial capsule, the temporomandibular joint is more or less completely enclosed in another capsule—the articular capsule—which covers all the bony parts of the joint, as well as the synovial capsule and the articular disc. The anterior superior surface of this capsule serves as an insertion for the superior head of the lateral pterygoid muscle.

This muscle is one of four muscles of mastication associated with the elevation of the mandible. Three of these muscles—lateral pterygoid, medial pterygoid, and temporal—are associated with the position of the condyle in the fossa, while the fourth—the masseter—gives power to the masticatory stroke. Of this group, the lateral pterygoid, inserted into the condyle and the capsule, originates by two heads (Fig. 3). The smaller superior head is from the greater

wing of the sphenoid bone along its infratemporal surface, and it extends to the infratemporal crest, while the inferior head takes its origin from the lateral surface of the lateral pterygoid plate. These two muscle bellies take an ascending course laterally to be inserted into the capsule and neck of the condyle. The fibers of the superior belly ascend very little from their origin to the insertion in the articular capsule, while the fibers of the inferior belly ascend more sharply to insert in the neck of the condyle. This illustrates that the direction of the muscle, from its origin to its insertion, is diagonal to the midsagittal plane of the skull. As a result of this direction, unilateral contraction of the muscle fibers of one side will move the mandible to the opposite side, while bilateral contraction will protrude and separate the mandible from the maxilla, as occurs in the opening of the mouth.

The temporal muscle, which is fan-shaped (Fig. 4), has its origin in the infratemporal line where it is the widest. From here it converges into a strong tendinous portion as it descends to gain part of its insertion into the crest of the coronoid process and part into the anterior surface of the ascending ramus; the lowest part of this insertion extends to the retromolar fossa. This muscle is divided into three bellies: anterior, middle, and posterior. Contraction of the fibers of the anterior and middle bellies elevates the mandible, while the contraction of the fibers of the posterior belly retrudes the mandible and places the condyle more within the confines of the articlular fossa.

The medial pterygoid muscle is found on the medial surface of the ascending ramus of the mandible (Fig. 5). Its origin is in the pterygoid fossa from where its fibers descend laterally, and backward, to be inserted into the medial surface of the ascending ramus near its angle. Contraction of the fibers of the medial pterygoid elevates the mandible. With the knowledge of the specific function and direction of contraction which each of these muscles imparts to the mandible, we now turn our attention to the consideration of how these factors are associated with the medial displacement of the fractured condyle. This we will illustrate schematically (Fig. 6) by a series of arrows showing the direction of pull of the fibers of the respective muscles. Let us assume that the line of subcondylar fracture is slightly below the insertion of the inferior belly of the lateral pterygoid muscle; the medial component of muscular contraction, as shown by the pleated arrow, of the lateral pterygoid muscle will have a tendency to pull the fractured segment medially, while the anterior component will pull it anteriorly. These combined forces exert themselves in such a manner that the fractured segment is pulled into the pterygopalatine fossa. As a result of this medial displacement of the condyle, the pressure-bearing point, with the teeth in occlusion, is transferred from the fossa to the last molar tooth. As a result of the changing of pressure-bearing points, it is conceivable to hypothesize that the combined function of the temporal and internal pterygoid muscles on the new bearing point may be laying the groundwork for an opening of the bite in the incisor teeth by depressing the molar teeth.

ANIMAL RESEARCH

In order to see what takes place in the temporomandibular joint when the condyle is lost, a number of research experiments were set up with the object

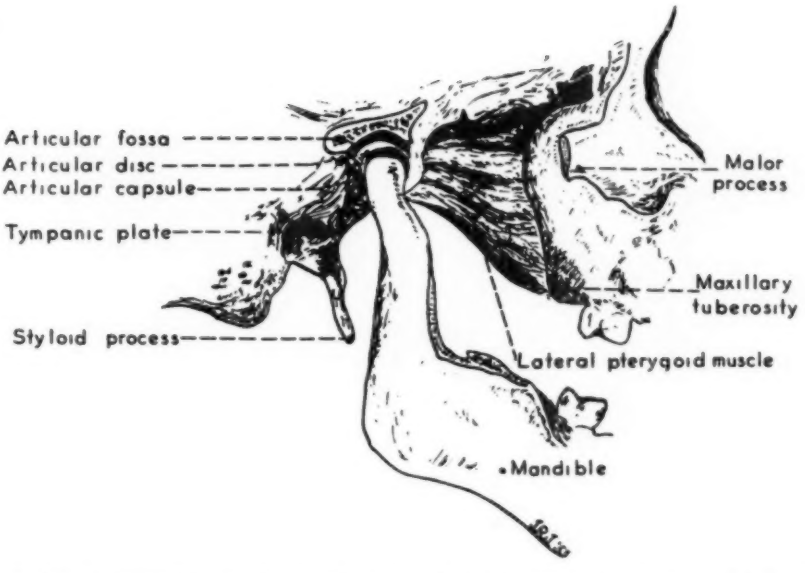


Fig. 3.—Lateral pterygoid muscle showing the origin, insertion, and course of the fibers.

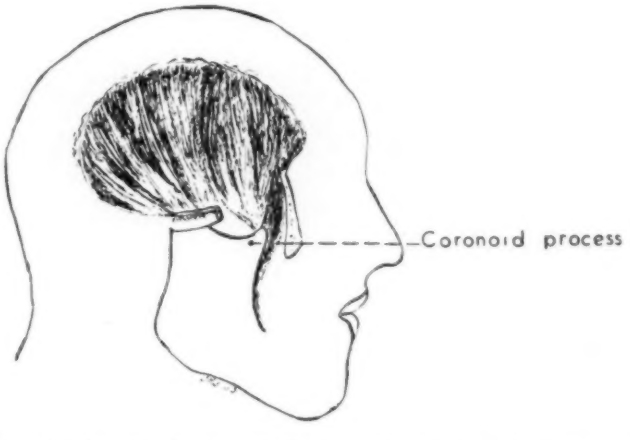


Fig. 4.—Temporal muscle showing its broad origin and narrow tendinous insertion.

Fig. 5.

DIRECTIONS OF PULL OF THE TEMPORAL AND PTERYGOID MUSCLES

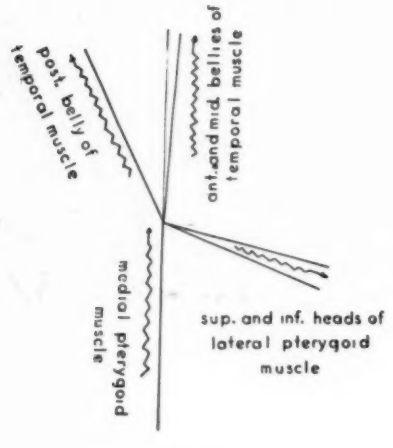


Fig. 6.

Fig. 5.—Medial pterygoid muscle, showing the insertion on the medial surface of the angle of the ramus and its origin in the maxilla and pterygoid plate.

Fig. 6.—Pleated arrows show the direction of pull of the medial and lateral pterygoid and temporal muscles.

of determining why we have mandibular and facial asymmetries developing in some instances and not in others.

In the first experiment, in a group of young rats, the mandibular condyle was sectioned and removed from the fossa on one side. After a short period of time had elapsed, some of the animals in the group began to develop asymmetrical patterns of function in mastication, while others continued to function normally.

Fig. 7.

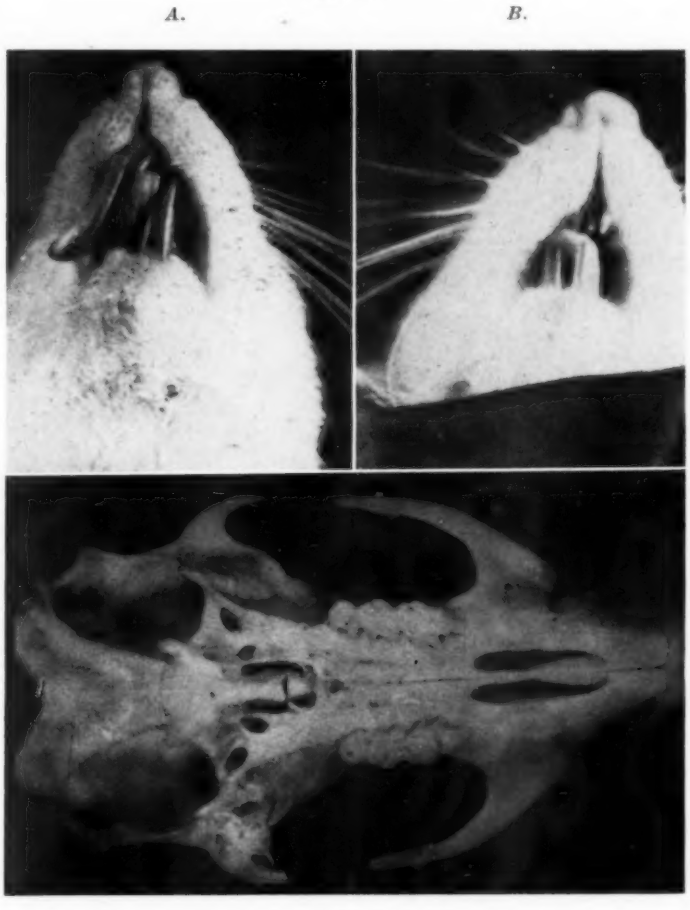


Fig. 8.

Fig. 7.—*A*, Abnormal pattern of function and attrition of rat incisors; *B*, normal pattern of attrition of rat incisors.

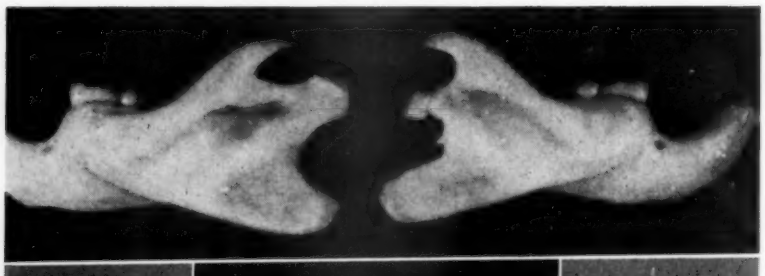
Fig. 8.—Articular fossa of the rat after unilateral condylar resection showing an area of calcification.

Those that showed asymmetrical function began to develop long incisors, which was a sign of change in the normal pattern of attrition (Fig. 7, *A*), while those in which the pattern of function was not changing continued to show a normal attritional pattern (Fig. 7, *B*). In order to study the progress of the facial asymmetry, the animals were allowed to reach their full growth; this was done by periodically cutting the upper and lower incisor teeth to prevent interlocking and to maintain freedom of function.

To determine the causes of the facial asymmetry in unilateral condylar resection, we first examined the articular fossa of the temporomandibular joint, and then the resected portion of the ramus. In the fossa, we found that a calcific conglomerate had been deposited whose peripheries extended beyond the limits of the fossa anteroposteriorly and whose center was irregularly jagged

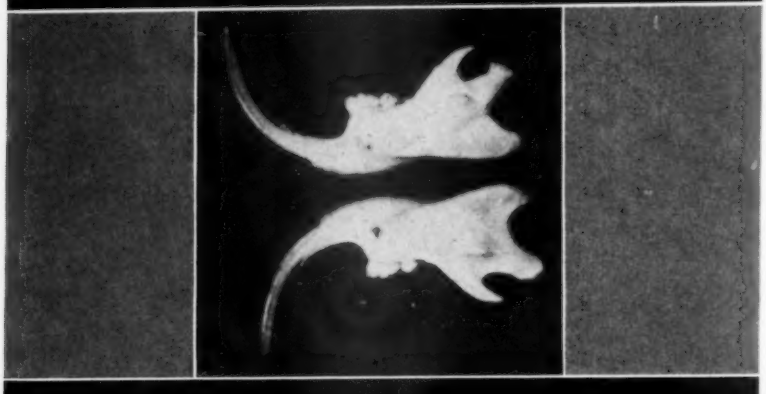
Normal Resection

Fig. 9.



Resection

Fig. 10.



Normal

Fig. 11.

Normal Regenerated condyle

Fig. 9.—The ascending ramus after condylar resection, showing the type of healing that takes place in an ankylosis.

Fig. 10.—Mandible of the rat after condylar resection, showing an apposition of bone to the sectioned neck.

Fig. 11.—Condylar regeneration in the rat after condylar resection.

(Fig. 8). An accretional formation of this type points to the development of a well-formed ankylosis, fibrous in the center and periphery. The resected end of the neck of the mandible in this animal has healed into a small irregularly shaped, screw-tailed projection (Fig. 9), which extends from the posterior border of the ascending ramus. The shape of this projection, its position on the distal surface of the mandible, and the morphologic configuration of the posterior

border of the ramus, as well as the inferior border of the mandible when compared with the nonoperated side, illustrate quite clearly that not only has there been an arrest in the growth of the ramus of the mandible, but there also has been a striking change in the general morphology. Thus, we see that destroying the condylar growth center not only increased the depth of the antegonial notch, but also increased surface apposition of new bone to the posterior border of the ascending ramus, thus making it wider from the angle to the retromolar fossa, and hence contributing to the facial asymmetry.

The adverse growth response in the resected mandible in this case is the result of one of the methods of healing in the temporomandibular joint after condylar destruction had taken place. This type of healing leads to the formation of an ankylosis in the joint, with subsequent development of a mandibular and facial asymmetry. Besides this method of bone repair, there are two others to be found in the temporomandibular joint of the rat which are not associated with the development of a functional, restricting ankylosis or a mandibular asymmetry. These are: (1) reapposition of bone to the resected stump, and (2) regeneration of the mandibular condyle. The first of these comes about as a reapposition of bone to the resected stump of the mandible. This new bone builds up until it reaches the fossa. In such healing, the reapposed structure, which for the most part resembles the neck of the normal condyle, is much longer than the original condyle. This additional length is made possible by space left after the articular disc was surgically removed from the joint. Histologically, this type of joint forms a simple fibrous ankylosis, which does not appear to impair function. It is evident that normal function remains because the attritional patterns of the molar and incisor teeth are unchanged. The second, and most desirable, type of healing is that of the regeneration of the mandibular condyle (Fig. 11). In this instance, the condylar structure that was removed by resection has regenerated to a point where it appears to be morphologically similar to the normal condyle, although somewhat smaller. Histologically, the reapposed condyle has a fibrous capsule similar to that of the normal condyle; however, the layers of cartilage are irregularly disposed, giving the appearance of being distributed in clusters interspersed by trabeculae of newly formed bone which may come up as high as the fibrous capsule. The attritional patterns of the teeth remained unchanged when compared with those of the control animal, which illustrates that at no time during the regeneration of the condyle was the position or size of the mandible changed appreciably to alter the occlusal function.

These experiments on condylar resection in the rat emphasize that the healing of the resected stump is not always the same. There are some instances where irregular apposition of bone takes place; this is coupled with the development of an ankylosis which ultimately results in morphologic changes in the mandible that reflect themselves as alterations in the symmetry of the mandible and face. An ankylosis with a definitely circumscribed calcific area was due in this case to the limitations of functional movements of the mandible. In experimental animals in which the function was not

impaired to any degree, there was a reapposition of the lost structure. This type of healing is possible only when the resected end of the mandible is kept out of the fossa by the forward pull of the large masseter muscle of the rat and where there is freedom of mandibular movements.

With the findings in the rat as criteria, we turned our attention to a study of the type of healing that would take place in the temporomandibular joint of an animal more akin to man (the monkey) following subcondylar resection. After the mandibular condyles of the right and left sides were surgically removed in a young monkey, this animal was kept for one year, a time which we felt was adequate for mandibular and facial changes to take place.

Fig. 12.—Formation of a new articular fossa on the articular eminence where the resected end of the mandible articulates.

Once again we examined to see the effects of a condylar resection. Examination of the fossae after subcondylar resection showed distinct islands of new bone in their centers and on their sides (Fig. 12), obliterating the normal fossa concavity. On the inferior border of the root of the zygoma, where normally the convex articular eminence appears, there was a concavity (Fig. 12, *B*) which developed as a result of the articulation of the resected end of the ramus on the articular eminence. From this finding, two deductions may be made relative to the mechanism of healing of the resected portion of the mandible. The first is that, after the removal of the mandibular condyle from its fossa, a new fossa will develop on the articular eminence in response to the function of the stump; and the second is that the new fossa is morphologically determined by the latitude of movement made by the healed surface of the resected part of the mandible as it travels through various paths in mastication.

From the changes in morphology of the articular fossae, we now turn to a consideration of the changes in the mandible of the monkey after condylar resection (Fig. 13). In the healing of the resected neck of the condyle in the monkey, there is a process similar to that of the rat shown in Fig. 10 in that there is a certain amount of apposition of new bone to the ramus at the site

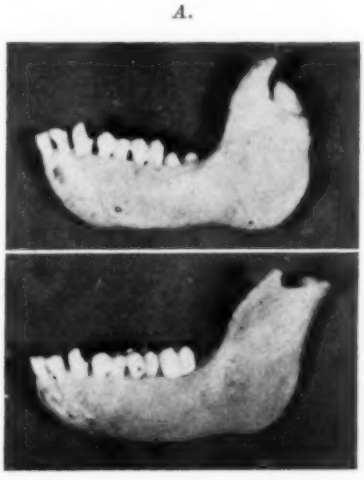


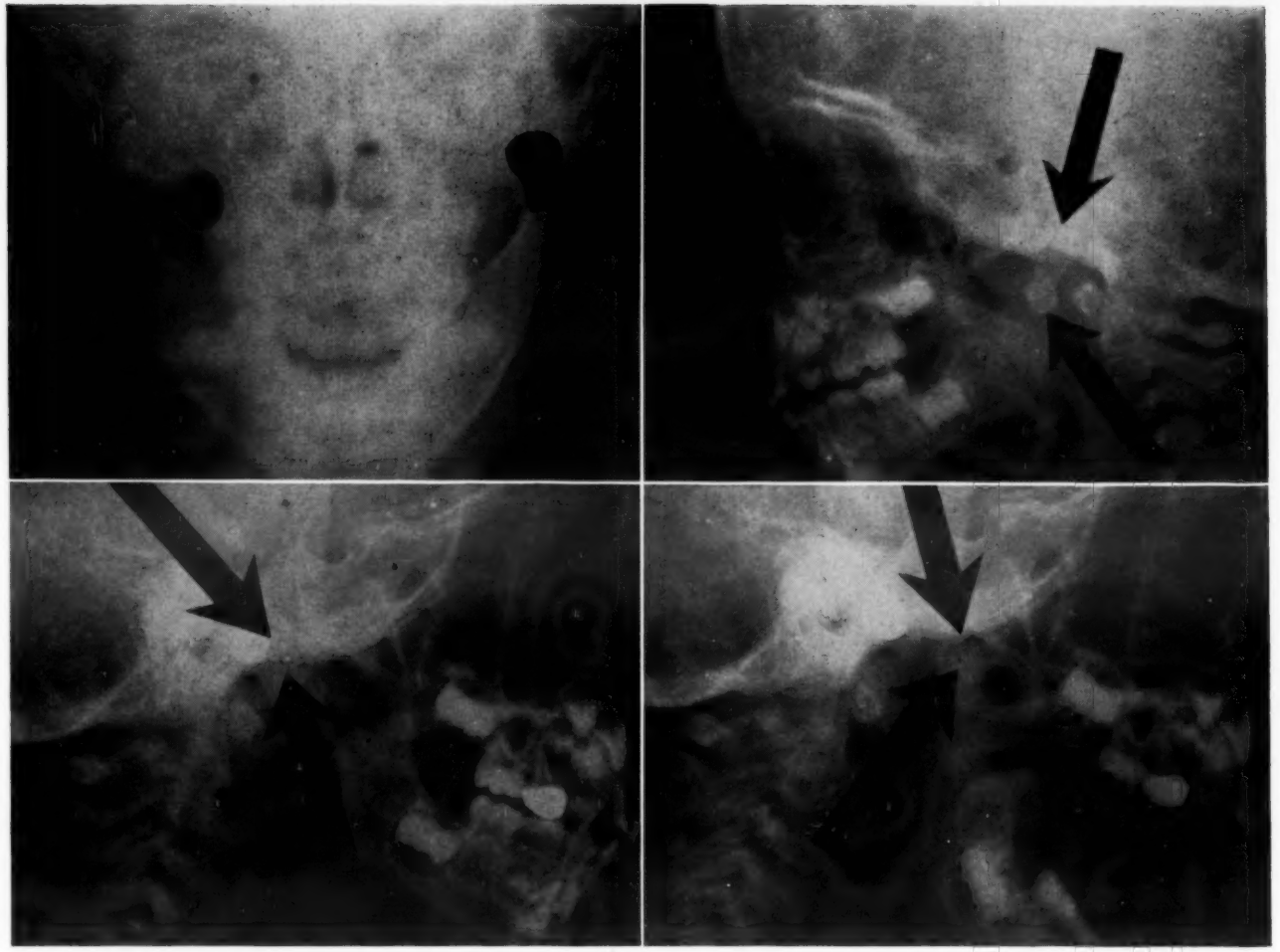
Fig. 13.—*A*, The form and shape of the body of the mandible of the monkey after condylar resection; *B*, shape and form of normal mandible.

Fig. 14.—*A*, Frontal view of the monkey, showing normal occlusion in the anterior region; *B*, frontal view after condylar resection, showing the development of an open-bite in the incisor region.

of resection. The edges of this newly apposed bone are rounded from front to back in such a manner as to form a simple hinge joint. It is the loss of both of the lateral pterygoid muscles, which precludes any possibility of a translatory movement within this new joint, that causes it to act as a simple hinge.

Fracture Fig. 15. Normal

Fig. 16.



Normal

Fractured

Fig. 17.

Fig. 18.

Fig. 15.—Anteroposterior radiograph illustrating by a superposed mask the extent of the medial displacement of the right condylar fragment.

Fig. 16.—Lateral radiograph. Labeled arrow points to the fractured fragment.

Fig. 17.—Lateral radiograph of a callus taken three and one-half months after fracture of the right mandibular condyle in a boy 3½ years old.

Fig. 18.—Arrows showing the relation of the callus to the articular fossa on the fractured side; also, the normal condyle to the fossa on the nonfractured side.

Continuing with the changes in morphology of the mandible after condylar resection, we compare the ascending ramus and the body of the mandible (Fig. 13, *A* and *B*) with that of the normal animal. Here it may be observed that the angle of the mandible of the experimental animal is more acute than that of the control; there is also some increase in the depth of the antegonial notch. This increase in depth, however, is not as great as that shown in the rat after condylar resection (Fig. 8). From these changes in morphology of the mandible, we may postulate that after condylar resection there is an increase in the surface apposition of bone along the posterior border of the ramus and of the angle of the mandible. It is conceivable that this emergency addition of bone is deposited in response to modification of the function of the internal pterygoid and temporal muscles.

We now turn our attention from the changes in morphology of the mandible after condylar resection to the effects of the loss of the condyles (Fig. 14, *A* and *B*) on occlusion. Comparing the occlusion of the left halves of the two skulls, it readily may be seen that, when the mandibular condyles were removed, there was a subsequent opening of the bite in the incisor teeth. This type of malocclusion is due to the changing of the pressure-bearing point from the articular fossa to the distal surfaces of the last molar teeth, and to the pulling of the temporal, masseter, and medial pterygoid muscles against this new pressure-bearing point; this results in a depression of the molar teeth and the opening of the bite in the incisor region. This explanation for the opening of the bite in the incisor region is strengthened by two other observations: (1) that this opening does not become noticeable until the third month, and (2) the formation of the new fossa does not begin to take place, radiographically, until about the same time. These observations indicate that the pressure-bearing point remains in the area of the last molar teeth until about the third month after condylar resection. The resection of the mandibular condyles in the monkey did not cause a distal displacement of the mandible, as one might expect, because in this animal the inclined planes of the cusps of the posterior and canine teeth are very acute, resulting in perfect cuspal interdigitation during mastication, thus making distal displacement impossible.

Granting that research on the resection of the condyles of the rat and monkey has produced strong evidence to support the premise that the growth of the mandible in a downward and forward direction may be halted, that its morphology may be changed, and that a form of malocclusion may result from the growth arrest, what reasons have we to believe that the findings of animal research in condylar removal can be used as criteria for the evaluation and treatment of subcondylar fractures in the human being? Why concern ourselves with growth arrest when the mandibular growth center still remains? Finally, how often do we remove fractured condyles in the human being, as we did experimentally in animals? For the answers to these questions we now turn to two sets of radiographs and one set of photographs taken on small children, illustrating the sequelae of subcondylar fractures in the human being.

normal condyle to the fossa on the nonfractured side.

The first radiographs are those taken of the 3½-year-old boy, previously mentioned, who sustained a subcondylar fracture on the right side (Fig. 15). The line of fracture and the extent of the medial displacement of the condyle shown by the mask indicate that the fragments are almost contiguous. The lateral radiograph (Fig. 16), which was taken at the same time as the anteroposterior view, shows a more radiopaque area lying on the ascending ramus; this is the fractured fragment. These radiographs illustrate the necessity for accurate positioning of the patient's head before taking the condylar and subcondylar radiographs. Anatomically, the position of the fragment in the anteroposterior radiograph is more in keeping with what we may expect from the direction of pull of the lateral pterygoid muscle than from what is seen in the lateral radiograph. The relation of the normal condyle to the displaced fragment in the lateral radiograph is out of proportion, but this can be explained by the fact that the boy had his head tipped to the right when the exposure was made. In subsequent radiographs taken twenty-one days later, there was no sign

Fig. 19.—The extent of posteromedial displacement of the fractured fragment shown by a mask which is a replica of the fragment (boy 6½ years old).

of a condyle on the right side; the fractured end of the ramus was irregularly jagged, and there was a mossy-like area detached from the ramus which was medially inclined. This area was the remains of the sequestrum of the fractured condylar segment. Lateral radiographs taken three and one-half months after the fracture (Fig. 17) show a well-organized callus developing on the fractured end of the ramus that is more radiopaque than the remaining part of the ascending ramus. The relation of this callus in width and length is shown in the radiograph (Fig. 18) taken of the temporomandibular joints when the mouth was open. This callus, radiographically, ultimately may give a morphologic appearance similar to that of the normal condyle, but it is too early to

determine how much facial and mandibular asymmetry, if any, will develop. If the callus formation shows the same characteristics as those seen in the regenerated condyle of the rat (Fig. 11), we have sufficient reason to believe that there will be very little or no facial asymmetry in this case. But again, it is too early to formulate a conclusion.

Fig. 20.

Fig. 21.

Fig. 20.—Lateral radiograph taken four and one-half months after the date of fracture in a boy 6½ years old.

Fig. 21.—Medial position of the condyle shown by the mask after healing of the fracture had taken place in a boy 6½ years old.

The following series of radiographs were taken after a unilateral subcondylar fracture on the right side of a 6½-year-old boy. In order to show the

extent of the medial displacement of the condyle, the condylar shadow (Fig. 19) partially obstructed by the shadow of the anterior root of the zygoma was duplicated by a mask. This mask then was placed on the condylar fragment in the radiographs; it shows the relation of the displaced fracture fragment to the ramus. The subcondylar fragment, which was dislodged medially, lies over the angular process of the sphenoid bone. In addition to the medial, there is also a posterior displacement of the fragment in the direction of the tympanic plate. Let us now examine a series of radiographs to see how this subcondylar fracture has healed. The first of these, a lateral radiograph (Fig. 20) taken four and one-half months after the fracture, shows that a very distinct callus has formed at the site of the fracture and that the posteromedially directed condylar fragment was attached to it. The posterior border of the ramus on the side of the fracture, when compared with the normal mandible, is irregularly concave. To show the degree of medial displacement remaining after the subcondylar fracture had healed, we compare the masks of the right and left rami (Fig. 21). The mild mandibular asymmetry that is beginning to develop in this patient is believed to be the result of the posteromedial position of the condyle and of the partial resorption (a remodeling) along its upper anterior curvature.

The final case is that of an 11½-year-old girl who had the right mandibular condyle surgically removed after receiving a compound subcondylar fracture in an automobile accident at the age of 8½ years. The removal of the fragments took place three weeks after the accident, but it was not until three years later that the patient saw an orthodontist and had photographs taken; the frontal is shown in Fig. 29, *A*. This photograph illustrates that in the interim after the condyle had been removed the patient developed a distinct facial asymmetry in which the upper and lower halves of the face became skewed to the right side, the side of the condylar removal. In addition to the facial asymmetry, an ankylosis developed, permitting the patient to open her mouth only three quarters of an inch.

DISCUSSION

These three cases were selected because, radiographically, they show that the findings in the human being after condylar fracture parallel those of animal research after condylar resection. The first of these cases illustrates the similarity between the effects of the loss of the mandibular condyle, by resorption in the human being, and those of condylar resection in the rat and monkey. One of these parallel effects is the type of callus formation seen in the 3½-year-old boy. In part, it resembles the articular structure of the regenerated condyle of the rat (Fig. 11). If a mandibular asymmetry does not develop in this patient within the next year, then we may assume that there are at least some areas of proliferating cartilage in the new condyle similar to those found in the rat, and that the growth of the mandible in a downward and forward direction is the result of proliferation of the cartilage and of new bone formation in these areas. On the other hand, if an asymmetry does begin to develop and the radiographic image still resembles the normal condyle, then we may assume that

the callus formation does not contain islands of cartilage and that growth in the area has stopped with the formation and organization of the bony callus, a condition parallel to that observed in the monkey.

Although the condyle was dislodged somewhat posteriorly and medially in the second case, the ends of the fractured fragments remain in contact with each other, a condition that is conducive to the reduction of the fracture by the formation of a good callus. With such an excellent union of fragments as seen in this case, it is difficult to explain with certainty what the actual cause of the early development of a mandibular asymmetry may be, but we can give two probable explanations. The first is based on the premise that, in addition to the posterior and medial displacement of the condyle after the subcondylar fracture took place, there was an inferior displacement of the neck of the condyle, lodging it below and between the fractured portion of the ramus and the tympanic plate. Because of this latter displacement, the condyle did not serve as a pressure-bearing point during the formation of the callus, which is essential to the downward and forward growth of the mandible. The second explanation for this asymmetry is based on the following: while the bony callus was forming at the ends of the fracture, there may have occurred a retardation in the proliferation of cartilage, a condition brought about by impaired circulation in the fractured fragment. The reduction in the cartilaginous proliferation, coupled with the resultant reduction in the tempo of new bone formation, may lead to a temporary mandibular asymmetry. This asymmetry will remain during the formative period of the hard callus and the remodeling of the mandibular condyle to its new position in the fossa, as illustrated by animal research. Finally, when the condyle has remodeled to the fossa, and the condylar pressure point once again has been re-established in the fossa, it is theoretically possible that the downward and forward growth of the mandible will be re-established.

In passing from a discussion of the parallels between animal research and observations on the human being after subcondylar fracture, we must turn once again to research for the explanation of why the condylar fragment is resorbed in one case and not in another. The results of numerous experiments on the healing of long bones in both man and animals, show clearly that as the distance between the fractured fragments is increased, so also is the difficulty of obtaining a good union. In many instances only a fibrous union is formed. In the 3½-year-old boy, where the condyle was resorbed, we saw that the fractured fragment had been pulled medially into the pterygopalatine fossa and, in all probability, had lost contact with the ramus. One result of this dislocation was a partial loss of the blood supply; another was that a barrier, the medial surface of the articular capsule, separated the fractured fragments from each other, making a union of the ends impossible. On the other hand, in the 6½-year-old boy, a bony callus developed because the fractured ends were in contact with each other and because the fragments were not displaced from the articular fossa and forced through the medial surface of the articular capsule by the pull of the lateral pterygoid muscle.

From this we may assume that the criteria for either resorption of the fractured fragment or the formation of a uniting callus are the same as those for the healing of the long bones of the body.

We now come to the discussion of the factors which contributed to the facial asymmetry in the third case, the case in which the condyle was surgically extirpated. The delay of several weeks that intervened between the accident and the removal of the fragment no doubt necessitated the destruction of part of the primary callus, during surgery; this hastened the formation of an ankylosis which progressively limited the motion within the joint. The condylar removal also brought about the formation of a new area of articulation on the posterior convexity of the articular eminence, an articulation similar to that experimentally produced in the monkey. In addition to these developments, the girl's age when the accident took place (8½ years), the limitation of function, and the loss of downward and forward growth that followed extirpation of the condylar growth center, were all factors germane to the development of the severe facial asymmetry seen in this patient.

Using the information obtained from research as a foundation, we will turn now to clinical methods used in the treatment of subcondylar fractures in keeping with these findings. The principal factor in the determination of the method of treatment of subcondylar fractures is the relation of the

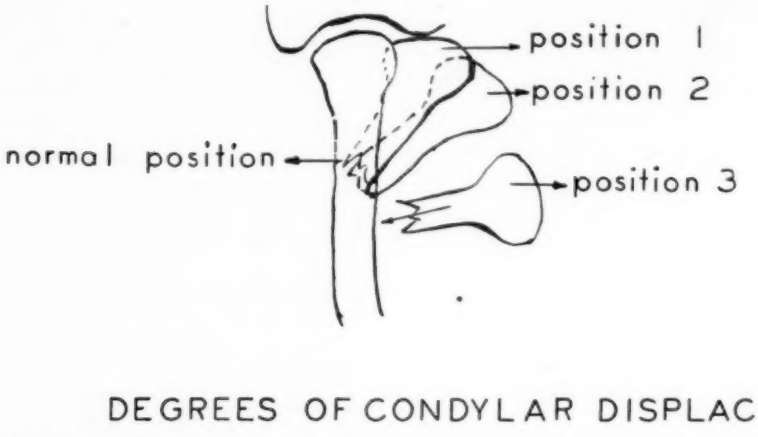


Fig. 22.—The most prevalent positions in which the condylar fragment may be found after subcondylar fracture.

fragments to each other. The condyle, as a result of a subcondylar fracture (Fig. 22), may be found in any number of positions; however, three are most prevalent. These may range from small to moderate medial displacements within the capsule to complete dislodgments outside the capsule into the pterygopalatine fossa.

For mild displacements within the capsule, we classify the condylar fragment as being in Position 1 (Fig. 22) when there is a medial anterior displacement of 3 to 5 mm., or a posterior displacement of 3 mm. coupled with either an anterior rotation of the medial surface or a posterior rotation of the lateral surface of the condylar fragment. For the reduction of this type of

fracture, there are three basic appliances used for the immobilization of the jaws: the first of these employs the banding of all teeth; the second makes use of a labial arch ligated to the teeth by wire ligatures; and the third is a simple intermaxillary ligation of the individual teeth to each other.

In order to immobilize the jaws with the first appliance, it is necessary to band all teeth anterior to the second molars with bracket bands (Fig. 23) and to fit an .022 arch wire to the brackets. Vertical hooks may be soldered or loops may be bent into the arch wire at the level of the interproximal spaces; they are directed gingivally for the engagement of the rubber band elastics. After the upper and lower arch wires have been secured in the brackets, intermaxillary elastics are placed in the manner shown in Fig. 23 to effect immobilization of the jaws. The second method (Fig. 24), which is less tedious than the first, employs a labial arch (0.36 to 0.40) with

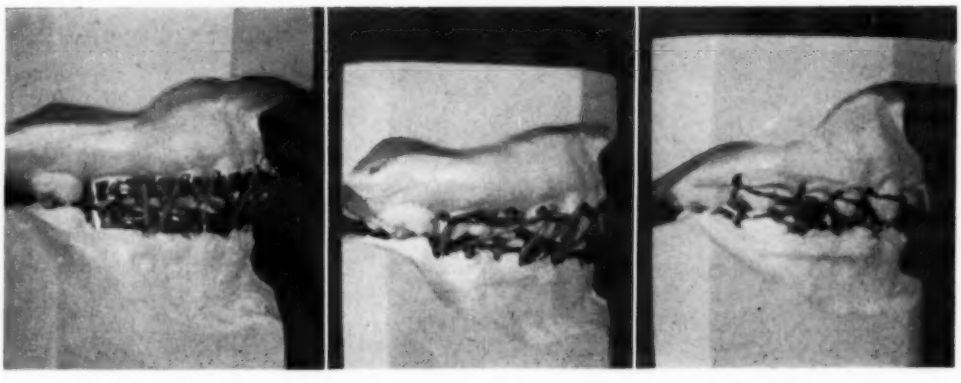


Fig. 23. Fig. 24. Fig. 25.

intermaxillary hooks or loops, in the same positions as the arch described in the first appliance. This arch is contoured to the gingival surfaces of the teeth, where it is wired by stainless steel ligatures that are drawn securely around the necks of the teeth. Intermaxillary elastics are employed in the same manner as described in the first method. In the third type of fixation (Fig. 25), brass ligatures are tied around the necks of the teeth in both arches and the free ends then are tied together to effect immobilization. This last method, useful in some cases, does not give the stability of the first two methods.

Cases in which the fractured fragment has been displaced more medially and anteriorly than in Position 1 are classified as being in Position 2. The fragment, although displaced quite considerably, has not penetrated through the medial surface of the articular capsule, and because of this the condylar fragment, in the distended articular capsule, still remains in contact with the ramus. The method of immobilization of the jaws and the fixation of the fragments in Position 2 is the same as previously described for Position 1. As the subcondylar fragment becomes displaced more medially from its original axial position to the ramus, the prognosis for a union of the frag-

ments, as well as that for the continuation of growth along the normal downward and forward axis becomes less favorable. Facial asymmetries are more likely to occur when the healing of the fracture takes place in Position 2.

We next consider the least favorable position: Position 3 of the condylar fragment. From the standpoint of reduction by orthodontic methods, such a fragment, torn through the medial surface of the capsule and lodged in the pterygopalatine fossa, generally does not come in contact with the ramus of the mandible because the two fractured surfaces are separated by the capsule. Any attempt to reduce this fracture by orthodontic methods is doomed to failure because immobilization will not only hasten the development of a fibrous ankylosis, but the time consumed in the immobilization may cause the condylar fragment to die and to form a sequestrum to be absorbed by the body. This is what occurred in the 3½-year-old patient previously described (Fig. 16).

Fig. 26.—Transosseous wiring of condylar fragment.

Since this presentation is an exploration of the role of the orthodontist in the reduction of subcondylar fractures, it would be beyond its scope to do more than mention that there are surgical methods of open reduction in the treatment of these conditions shown in Position 3. Transosseous wiring, as shown in Fig. 26, is the simplest form of open reduction of subcondylar fractures. In this method the ends of the fractured fragments are placed as nearly in contact with each other as possible, and then are wired together with 0.20 stainless steel wire. A method of greater stability was developed by Dr. Orion Stuteville, who employs the stainless steel insert plate fixed by screws to the fragments, as a medium of fixation. Experimentally, the results of this method of fixation are seen in the monkey in Fig. 27, *A* and *B*, and in the human being in Fig. 27, *C*. This method of fixation, when employed

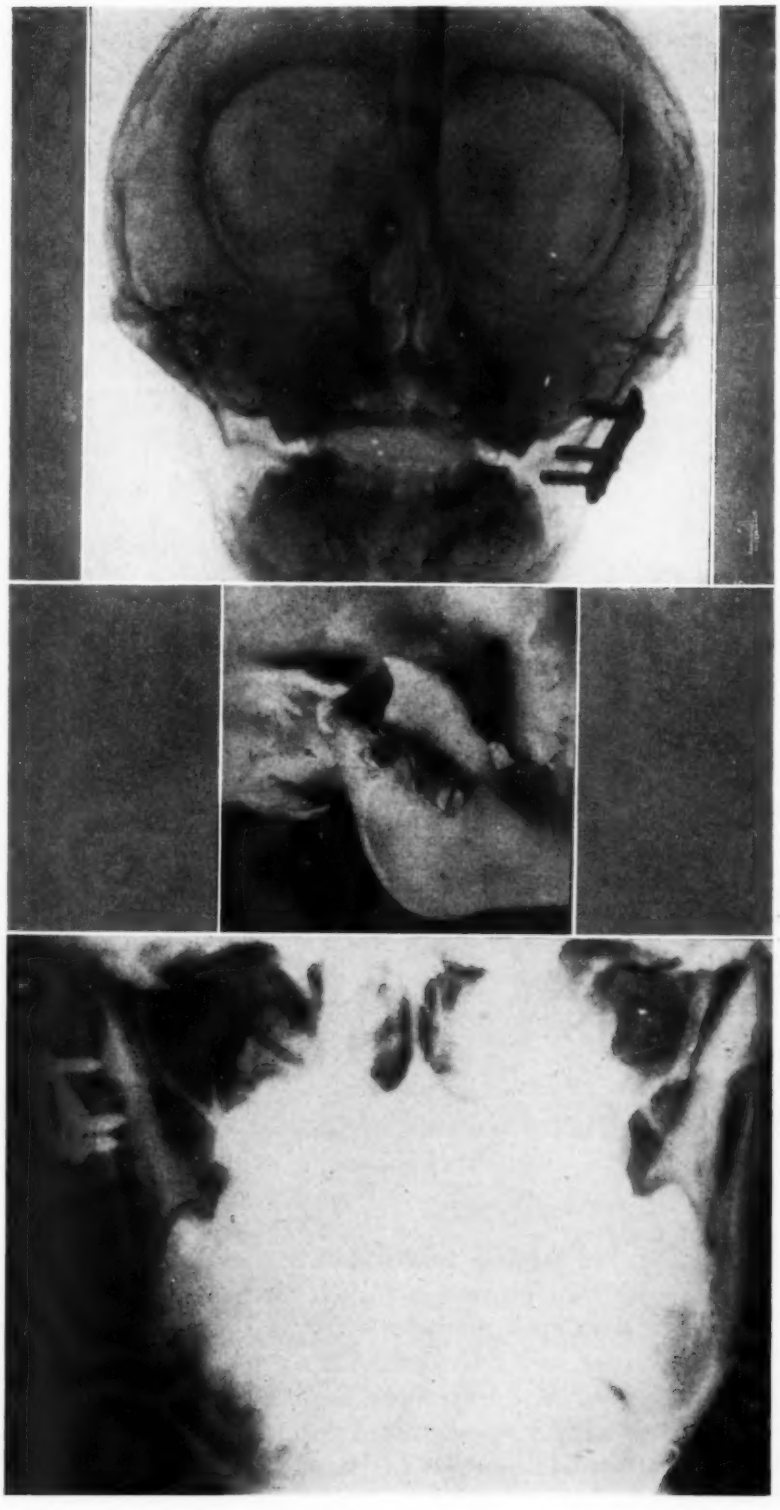
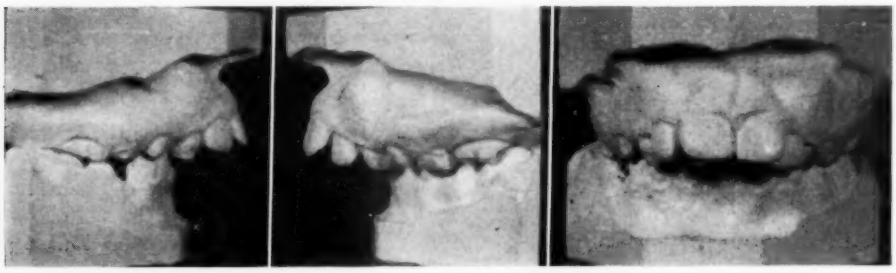


Fig. 27.—*A*, Fixation of fracture fragments by insert plate in the monkey; *B*, fixation by insert plate in the human being.

in the reduction of subcondylar fracture in the growing child, permits growth of bone in the condyle to continue, allowing the downward and forward growth of the mandible to go on unhampered.

The methods of reduction of subcondylar fractures, orthodontic and surgical, as outlined in the preceding paragraphs are effective only when they are instituted shortly after the subcondylar fracture occurs. However, there are other cases in which either the fracture goes unnoticed and the condyle is lost by resorption, or the fragments are removed surgically. In either instance there is a loss of the condylar growth center, ultimately resulting in a development of a dental and facial asymmetry. The extent of this asym-



A. *B.* *C.*

Fig. 28.—Casts before treatment.

A. *B.* *C.*

Fig. 29.—Photographs before treatment.

metry is dependent, for the most part, on the growth level of the face at the time when the condylar growth center is lost. In the rehabilitation of patients who have developed an asymmetry as the result of the loss of the condylar growth center, the orthodontist must use every available means at his command not only to correct the malocclusion but also, through its correction, to obtain a more undistorted face. It is with these thoughts in mind that the treatment to be described was developed for the 11½-year-old patient who, as a result of a condylar extirpation, had developed a disfiguring malocclusion and facial asymmetry.

An examination of the casts reveals that, as a result of the loss of the lower right first premolar coupled with a loss of mandibular growth on the same side (Fig. 28), there has been a shifting of the dental units to the right side, the side where the condyle had been removed. With the casts in occlusion (Fig. 28), the maxillary incisor teeth overjet $\frac{5}{8}$ inch beyond the mandibular incisors. Examining the face of this patient (Fig. 29, *C*), from the left profile photograph, it becomes quite apparent that growth in the undamaged condyle is being reflected not in a downward and forward direction, but laterally to the side where the condylar removal had taken place. By contrast, the lack of horizontal mandibular growth in the ramus is more

Fig. 30.

Fig. 31.

Fig. 32.

Fig. 30.—Acrylic exerciser.
Fig. 31.—Rubber exerciser.
Fig. 32.—Cervical elastic strap.

obvious on the left side, the side on which the condyle remains, than on the right side (Fig. 29, *B*), the side from which the growth center has been removed. From the frontal aspect (Fig. 29, *A*), the face is skewed to the side of the condylar removal, making the deformity appear more obvious on the side where the condyle remains intact than on the side where it has been removed.

As has been mentioned previously, the ankylosis which developed on the side of condylar removal made opening of the mouth beyond ¾ inch impossible. Therefore, in the design of the treatment, we worked on the supposition that to obtain a good functional occlusion it would be necessary first to eliminate the factors restricting function. This made it imperative that we increase the latitude of movements in the ankylosed joint, an increase which was accomplished through biting exercises. These exercises were first done on the acrylic occlusal splint shown in Fig. 30. However, because of the lack of resilience in the acrylic block, her lateral movements were restricted and she was unable to bite down with a maximal force. To obviate this, an occlusal exerciser (Fig. 31) was made of rubber (55 durometer hardness when vulcanized) and fitted securely to the upper teeth. The surface that came in contact with the occlusal surfaces of the lower teeth was trimmed to an incline plane whose surface was directed medially so as to permit the patient to thrust the mandible toward the side to where the condyle was intact, when she bit into the exerciser. The patient bit into the exerciser vigorously during the day and, to retain the freedom of movement which had been obtained by stretching the fibers of the ankylosed joint, she wore a more rigidly fixed device constructed of acrylic resins at night. A 2 mm. thickness of acrylic was added weekly to the incline plane of this device so that the patient would maintain an opening in excess of the free-way space during the sleeping hours. This kept the fibers of the ankylosed joint stretched during the night. After these appliances had been worn for six months, the patient could open her mouth 1½ inches. At this time the diseased maxillary first molar teeth were extracted to provide space for the retraction of the upper anterior and premolar teeth.

In preparation for this next phase of treatment, the teeth anterior to the extracted molar teeth were banded with edgewise bracket bands, and the upper second molar teeth were banded with formed bands to which 0.22 by 0.28 buccal tubes were soldered. A stainless steel arch, into which two vertical loops (to serve as intermaxillary hooks) were formed distal to the upper canine teeth, was tied into the brackets. Since this arch had no stops in the molar region, it would slide distally through the molar tubes when a distally directed traction force, obtained from an elastic cervical band similar to the one shown in Fig. 32, was applied to the hooks distal to the canine teeth. This device was worn from twelve to fourteen hours daily for a nine-and-one-half-month period. After that time, the upper round arch was removed and replaced by an 0.21 by 0.25 upper edgewise arch wire of similar design. The purpose of this rectangular arch wire was to upright the incisor teeth, lingually tipped by the pull of the cervical strap, and to close the remaining spaces between the mesial of the second molar and distal of the second bicuspid teeth. To correct the axial inclination of the anterior teeth, lingual root torque was placed into the anterior segment of the edgewise arch, and to close the spaces, *intramaxillary* elastics were worn from the hooks placed on the arch wire distal to the canine teeth, to the extension of the arch wire

beyond the distal ends of the second molar buccal tubes. Also at this time, edgewise bracket bands were placed on the lower anterior and premolar teeth, and molar bands, carrying the conventional rectangular buccal tubes, were placed on the molar teeth. The purpose for placing the lower appliance was twofold: first, to reduce the lingual cross-bite of the teeth in the lower buccal segment; second, to lengthen the arch on the right side by the width of one premolar tooth. This was part of the distance lost when the posterior teeth migrated forward into the space of the first premolar and canine teeth, the teeth whose buds were lost in the accident. This phase of the treatment was

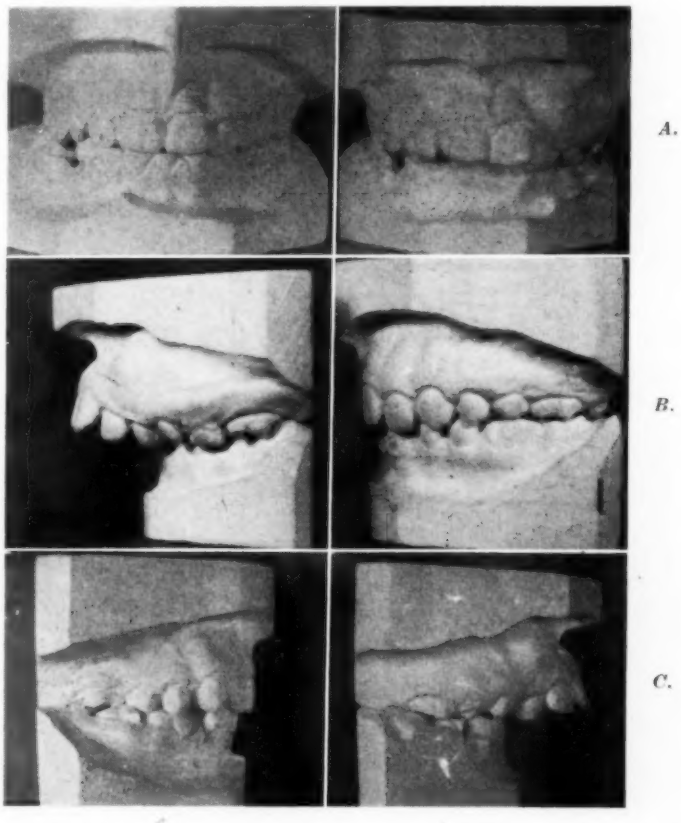


Fig. 33.—Casts before and after treatment. *A*, frontal; *B*, left; *C*, right.

accomplished in eight months. After a combined period of treatment that lasted slightly more than two years, seventeen months of which was used in the treatment with active appliances, the appliances were removed, and the case was retained with an acrylic incline plane retainer. Functional exercises were also continued on the rubber exerciser for two hours each day. The results of this treatment (Fig. 33, *F*, *R*, and *L*) upon the denture are shown in the next series of photographs of casts that were taken immediately upon the removal of appliances. From these we can see that the protrusion of the maxillary teeth was reduced. In addition to this, the cross-bite on the lower left side was also reduced and the lower left arch segment was increased in length.

A. B.

C. D.

Fig. 34.—Facial photographs after treatment.

A.

B.

Fig. 35.—Facial photographs before and after treatment.

Because of this increase, the axial inclination of the lower incisor teeth was increased 18 degrees. This made the lower anterior teeth appear procumbent, an undesirable sequela of treatment.

Fig. 34 shows the face of this patient after the appliances were removed. Comparing these photographs with those taken at the beginning of treatment (Fig. 35, *A*), we see a face of what was once a dentofacial cripple rehabilitated to one of an attractive young lady. This is an example of how the findings of research can go hand in hand with the clinical rationale in the management of difficult orthodontic problems.

Although there are many limitations in orthodontic treatment, research—a slow, cumulative process of learning—is lessening them, closing the gap between the known and the unknown. While very intriguing to the researcher, the results of research are often dull in the telling; details tend to obscure interest. Nevertheless, the applicability of research to the conduct of everyday practice is of vital importance, as it is the surest criterion that we have of the truth; it is the beacon that pierces the darkness, that gives us confidence as we search for the treatment of conditions whose etiology still remains obscure. We should be grateful that continuing research and the accumulation of knowledge have made the practice of clinical orthodontics no longer an empirical pursuit. At long last we see the dawn of orthodontics as a true science, an art of healing.

4302 Parrish Ave.

MASTICATORY FUNCTION OF CHILDREN WITH ORTHODONTIC DISTURBANCES

R. S. Manly, Ph.D., F. S. Hoffmeistr, D.M.D.,* and A. Yurkstas, D.M.D.
Boston, Mass.

DURING the last five years our laboratory has cooperated with dental specialists in several fields in order to assist them to evaluate masticatory function of patients with whom they were concerned. Studies have been made of young adults,[1] full denture patients,[2] partial denture patients,[3] children,[4] and cleft palate patients.[5] Our general purpose has been to determine the average chewing ability of patients in these various groups, and to evaluate the range of variation within each group. If we assume that one of the aims of dental treatment is to restore masticatory function to normal, it is necessary to determine what normal function is, whether or not dental deficiency or abnormality reduces function, and finally to learn the extent to which dental treatment brings about a restoration of the normal function.

Our endeavor in this study was to learn whether malocclusion generally causes impairment of masticatory function, to determine to what extent disturbance in function occurs among different orthodontic classifications, and to try to gain insight as to how masticatory function is changed by orthodontic treatment.

Our approach to the problem was simply to make clinical observations and masticatory function tests on 170 orthodontic patients. Two examinations, ten to fourteen months apart, were made on nearly every patient, in order to provide information on the changes which might occur as the treatment was begun, as it progressed, or after it had been completed.

The clinical examinations consisted of complete oral, dental, orthodontic, and craniometric examinations, including intraoral, extraoral, and craniometric roentgenograms. Models were prepared for each patient. Masticatory function was evaluated by several means in a manner similar to that employed by Shiere and Manly[4] in their investigation of patients of the Department of Pedodontics and the schools of Westwood, Massachusetts.

A summary of the types of observations and measurements made on each patient is presented in Fig. 1, together with some indication of the possible ways in which these observations might interact. The information has been grouped into three categories. On the left are the general factors which may influence the masticatory function of the orthodontic patient to a greater or less extent than they influence the function of an unselected group of children. In the middle column are given some of the measurements which characterize

Read before the Northeastern Society of Orthodontists, Nov. 9 and 10, 1953.
Aided by a grant from the U. S. Public Health Service, No. D54C.
*Present address—The Johns Hopkins Hospital, Baltimore, Md.

masticatory function, and on the right are three of the several orthodontic observations. Preliminary observations on these patients have been presented before,[6] but this is the first attempt to make a systematic analysis of the findings.

This presentation is to be limited to an analysis of the way in which the general factors affect the chewing function of orthodontic patients. Such analysis should precede a study of the contribution by orthodontic factors. It is necessary in order to simplify the problem of interpretation of the influence of orthodontic factors and to lessen the chances for error in such interpretation. For example of the complications, let us assume that every one of the general factors has an important influence on chewing ability. There are two sexes, two sides of each mouth, at least ten ages of patients, fifteen combinations of posterior dentitions with or without missing teeth, either with or with-

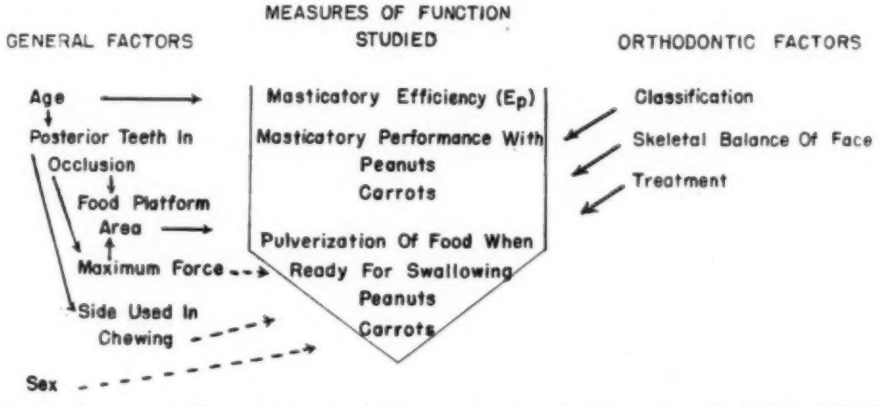


Fig. 1.—Factors studied which may influence chewing function of orthodontic patients.

out orthodontic appliances. There are several different levels of food platform area and maximum force. If all of these were important and if the patients were equally distributed, there would be less than one patient in each category, and interpretation of the results would be very difficult. This analysis was undertaken with the hope of finding that several of these general factors were unimportant, and could be disregarded.

Failure to consider these general factors also might lead us to errors of interpretation. It was observed, for example, that treatment generally brings about an increase in efficiency, which could lead to the hasty conclusion that the point of our study had been proved. The complication is that treatment takes place over a year or more, during which the child grows older and teeth sometimes erupt. Both of these influences have been shown by Shiere and Manly to cause higher masticatory efficiency of children who have not received orthodontic treatment. Similar complications might occur in trying to compare patients having different orthodontic classifications. The groups might differ as to age, teeth in occlusion, maximum force, or food platform area, and few safe conclusions could be reached.

There are five types of masticatory function measurements indicated in Fig. 1. Masticatory efficiency, in our opinion, is the most important of the five. It is calculated from the results of masticatory performance by con-

version from a table published recently.[7] The performance test was carried out by having the patient chew three separate 3-Gm. portions for twenty masticatory strokes. Each of the samples of chewed food is poured through a ten-mesh screen and the volumes of food passing and remaining on the screen are read after centrifuging.[8] This test provides a satisfactory indication of ability to chew soft food.

Our analysis of the data will consist of evaluating how the average efficiency of different groups is affected by the factor being considered. Some of these patients were under treatment at the time of the first examination and wore orthodontic appliances. It seemed important to determine whether or

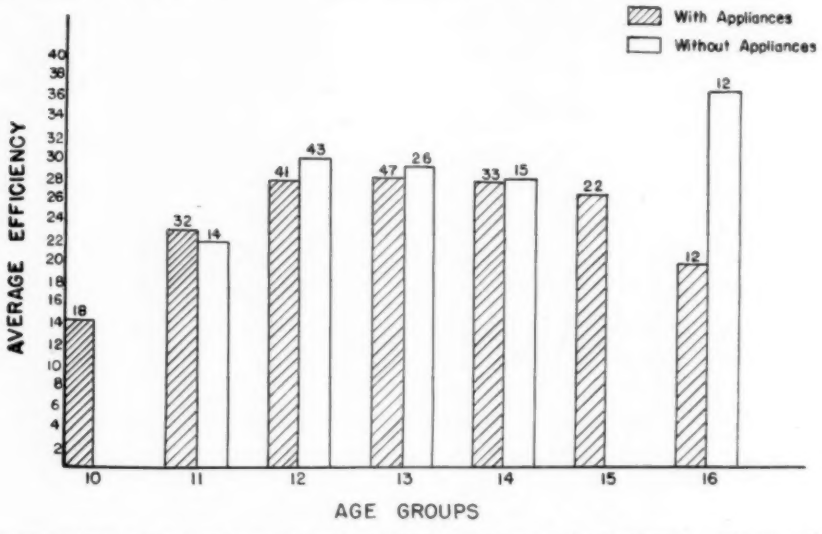


Fig. 2.—Comparison of patients with and without appliances (orthodontic patients, first visit, except Class III).

not those with an appliance would show the same average efficiency as those without the appliance. The groups were compared at different age levels, since age has been shown to be an important influence on masticatory efficiency of children.[4] The results are shown in Fig. 2. The ages of the patients are given on the horizontal axis and average efficiency by the heights of the columns. Groups having less than ten patients have been omitted. The cross hatched columns show the efficiencies of patients with appliances and the open columns show findings from those with no appliances. At age levels 11, 12, 13, and 14 there is no indication of a difference that can be attributable to the appliance. At age 16 there is a definite difference between the two groups. This seems to be attributable to a chance inclusion of high efficiency patients in one group rather than to a real effort of the appliance, and there were only twelve cases in the group. It is likely that an appliance which has been recently placed or adjusted will cause enough sensitivity to lower the chewing efficiency of the patient, but there must have been relatively few of these among our group; otherwise, the average efficiency would have been lowered. As a first approximation, we apparently can group together all patients, whether or not they are wearing appliances.

The second comparison was between the average efficiencies of boys and girls at the different age levels. The results are shown in Fig. 3. Groups below 10 years and above 15 years were omitted when they had less than ten pa-

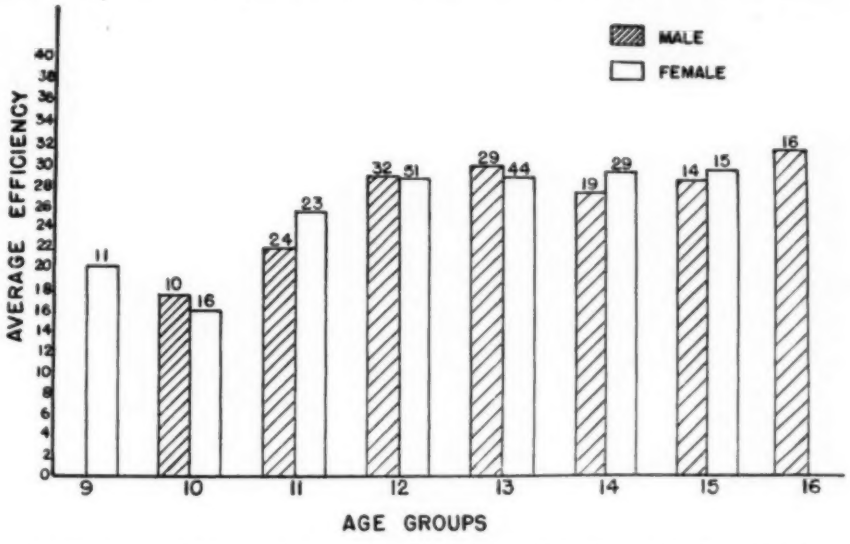


Fig. 3.—Masticatory efficiency, male versus female (orthodontic patients, first visit, except Class III).

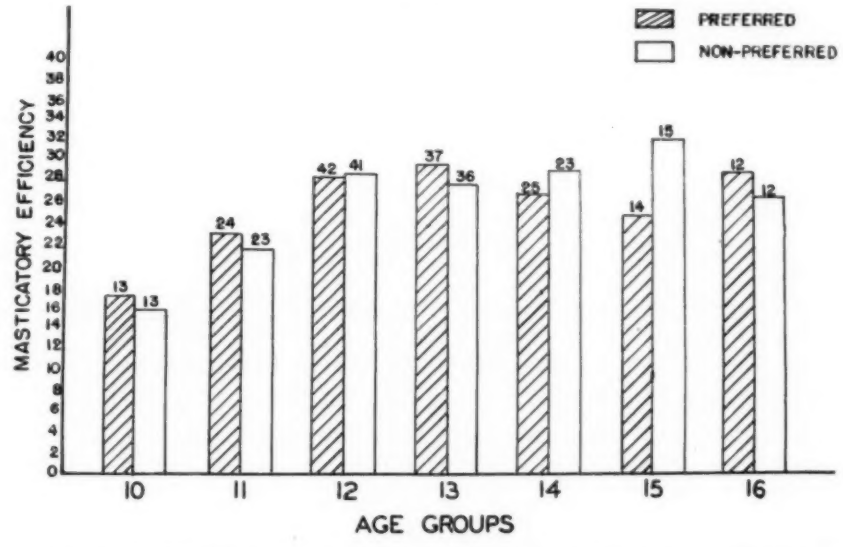


Fig. 4.—Masticatory efficiency, preferred side versus nonpreferred side (orthodontic patients, except Class II).

tients in the group. The general effect of age is to cause definite increase in masticatory efficiency from age 10 to age 12, but from age 12 to age 16 the efficiency seems to remain the same. There is no evidence of differences between chewing efficiencies of boys and girls. This finding allows us to group together all patients, regardless of sex. Fig. 4 gives an analysis of the preferred side of the dentition in comparison with the efficiency of the other side. Here there are 330 sides from age 10 to 16, inclusive. The preferred side shows a higher average efficiency in four cases, a lower average efficiency in

two cases, and identical in one case at 12 years of age. This does not indicate that the side preferred by the child for mastication is likely to be more efficient than is the other side. Adults generally prefer the most efficient side of the dentition in case there is a more than 10 per cent difference in efficiency. This finding parallels the results for children included in the study by Shiere and Manly.[4] The children generally preferred the right side of the dentition rather than the most efficient side of the dentition, except where there were extreme differences in chewing ability. The same thing held true for this group. Three-fourths of the children preferred the right side of the dentition, which probably means that we are comparing the dominant side of the dentition with the other side, rather than comparing the more efficient side with the less efficient side. This finding is helpful. It allows us to consider each side of each patient as a separate measurement in our further analysis.

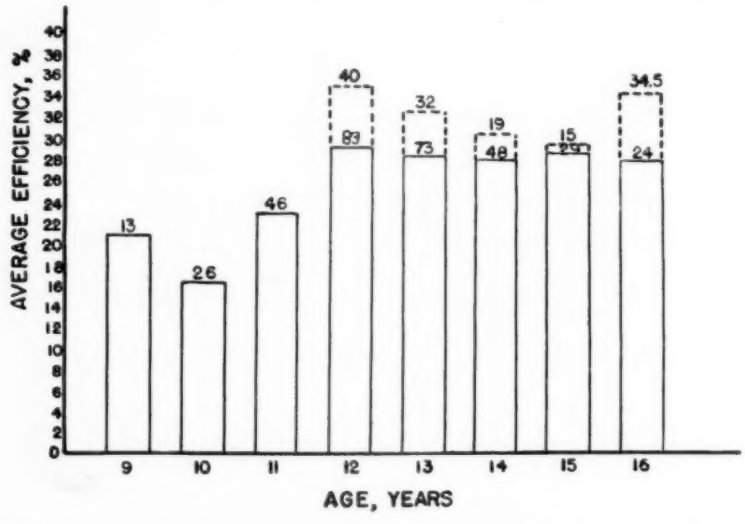


Fig. 5.—Masticatory efficiency versus age (orthodontic patients, first visit, Class III).

We now are able to evaluate the importance of age alone as a variable. Fig. 5 shows the comparison of the average efficiency for all the half dentitions from age 9 to age 16. Class III orthodontic disturbances have been omitted because their number was small. Efficiency rises from ages 10 to 12, inclusive, then remains almost the same from ages 12 to 16. This result is helpful to us in planning further analysis, because it shows that age does not influence efficiency over the range of 12 to 16 years. The average efficiency of this group does not rise above 30 per cent, which is low by comparison with the findings of Shiere and Manly on unselected children who had complete dentitions. Such children averaged about 70 per cent in efficiency at age 9 to 10, fell and remained at 50 per cent through ages 11 to 13, and rose again to 65 per cent at age 14. The orthodontic patients averaged only one-half as great at age 14.

One of the differences between the groups was the question of missing teeth. Perhaps there were many missing teeth among the orthodontic patients. This question led us to evaluate the relationship between masticatory efficiency

and the number of teeth in occlusion. It can be seen from Fig. 5 that between the ages of 12 and 16, inclusive, the age has no significant bearing on the chewing ability, which means that within this age range all ages can be considered as one group. Fig. 6 presents for this group a comparison between the masticatory efficiency and the numbers and types of posterior teeth in occlusion. The average efficiency is shown by the height of the column with the standard error of the mean indicated by means of the vertical lines in the middle of the column. The different dentitions are placed generally in the order of decreasing average efficiency. The efficiency of complete dentitions is greater on the average than that of the others, but the average is still only 33 per cent, which is only one-half as great as was found by Shiere and Manly for children with this age range. It appears that this group of patients with a complete dentition and orthodontic disturbances have generally lower masticatory efficiency than unselected children who have complete dentitions.

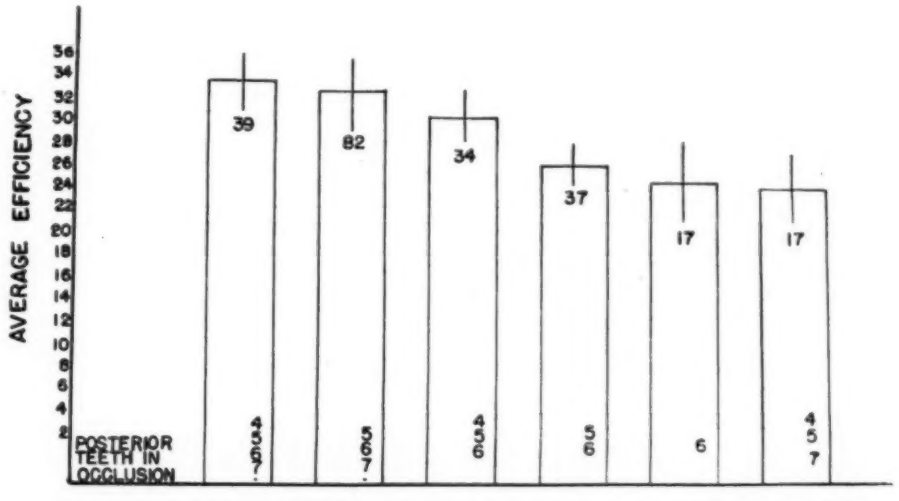


Fig. 6.—Masticatory efficiency versus posterior teeth in occlusion (orthodontic patients, except Class III, ages 12 to 16, inclusive).

Fig. 6 permits an estimate of the value of different teeth in contributing to masticatory efficiency of orthodontic patients. There was no difference statistically between complete dentitions and dentitions lacking only the first premolar. The difference is only 1 per cent. On the basis of the area contributed by the first premolar to the adult dentition, one would expect that there would be about 2 per cent difference in efficiency (5). The loss of the second molar has surprisingly little effect, in that it reduced the efficiency by only 3 per cent, whereas from the study on adult second molars, one would expect that there will be a reduction of 9 per cent, judging from the contribution that molar makes to the food platform area of one side of the dentition. Loss of both the first premolar and the second molar had greater effect on the average chewing ability of the orthodontic patient and the loss of the second premolar in addition did not change this figure by a great amount. The

last two columns show how important the first molar appears to be from the standpoint of mastication. Seventeen dentitions with only a first molar occlusion averaged the same in efficiency as the seventeen dentitions which had all teeth in occlusion except the first molar. It seems that these figures might have some value to orthodontists in case they have to reach decisions regarding extraction of teeth.

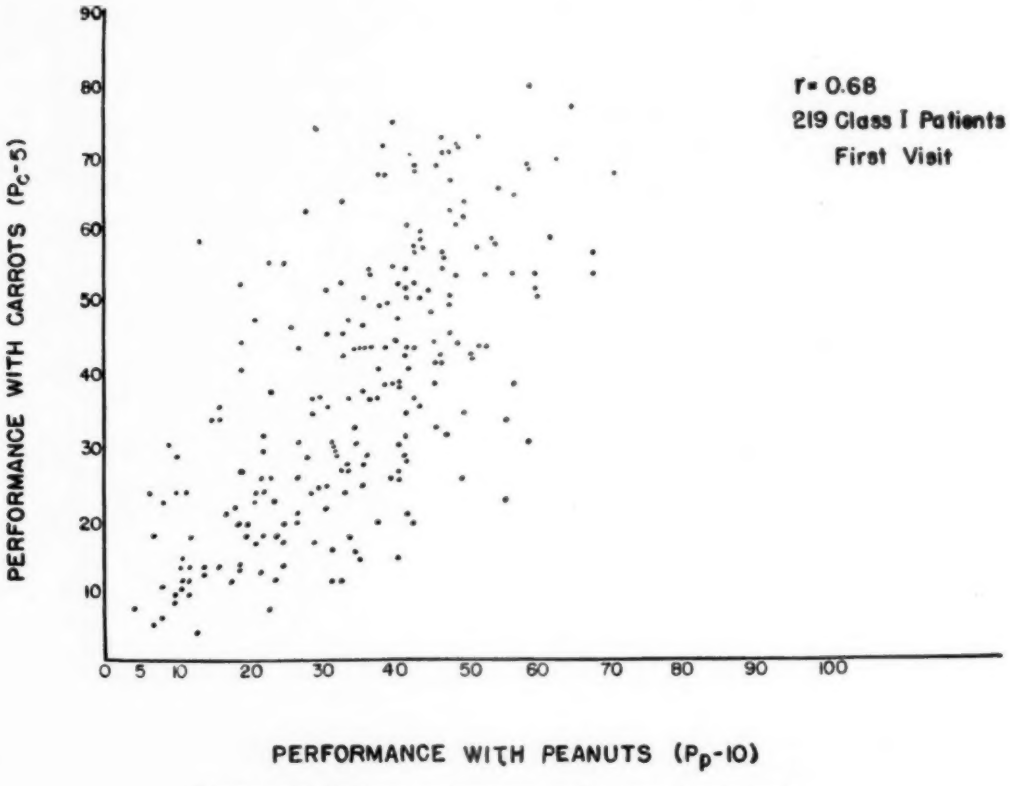

r = 0.68
219 Class I Patients
First Visit
PERFORMANCE WITH CARROTS (P_C-5)
PERFORMANCE WITH PEANUTS (P_p-10)
0 5 10 20 30 40 50 60 70 80 90 100
10 20 30 40 50 60 70 80 90

Fig. 7.—Masticatory performance, soft versus tough foods.

In all these instances the comparisons have been made between some general factor and masticatory efficiency. This efficiency is defined as being the relative number of masticatory strokes required by a patient in order for him to pulverize food to a standard degree fineness. For example, a person who requires twice as many strokes to pulverize his food, in comparison with a normal adult with two molars and two premolars in occlusion, would be judged to have 50 per cent masticatory efficiency. It has been calculated from the figures on masticatory performance with a soft food, peanuts. The next question seemed to be whether or not the figures on chewing ability with a soft food would be related to those obtained by using hard food as a test substance. It has been found that carrots are ideal as a test food because of the forces required to crush them and their resistance to pulverization. The ability to chew a tough food usually runs hand in hand with the ability to chew soft food. This is shown to be true by Fig. 7. A moderate degree of cor-

relation exists between masticatory performance using carrots and peanuts as test foods. This correlation coefficient is not as great as has been found for adults, but it is sufficiently high to indicate that masticatory efficiency which is based on a test with soft foods will be generally valuable to indicate chewing efficiency with all types of food.

Finally, there is the question of the extent to which poor efficiency affects the fineness of food that is swallowed by the patient. Generally the patient makes no compensation for poor efficiency other than to swallow coarser food.

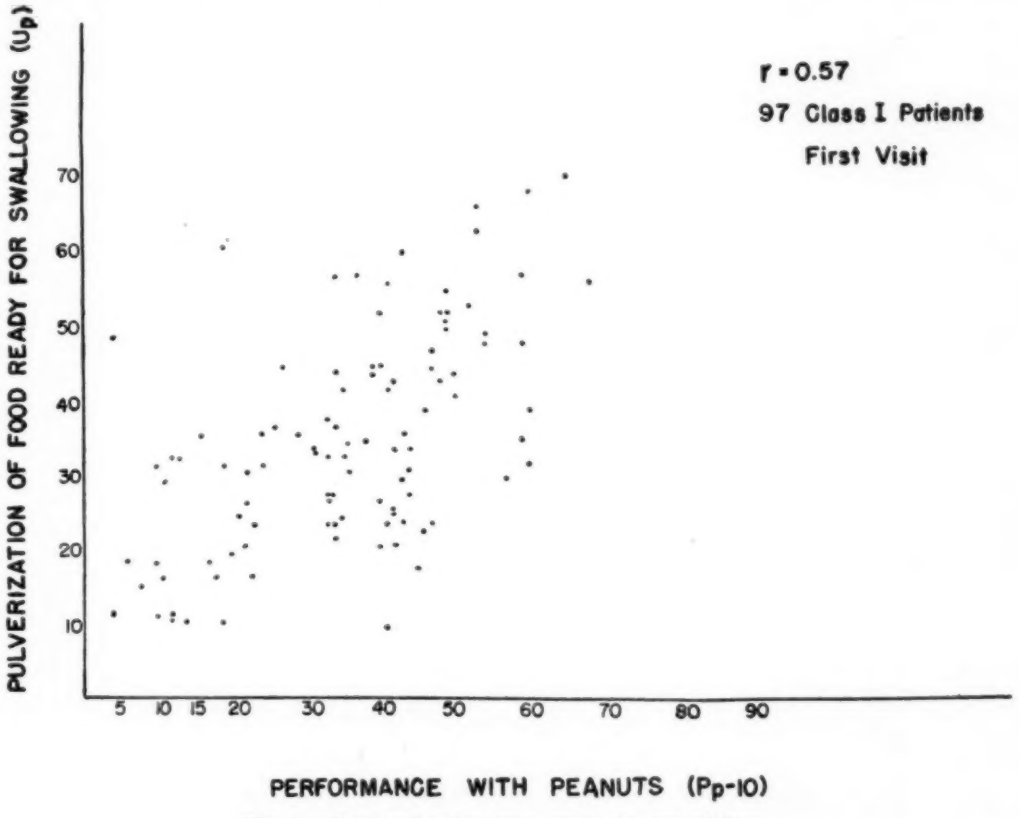


Fig. 8.—Food pulverization versus chewing ability.

One of the tests involved allowing the patient to chew food until he judged it to be ready for swallowing. At this point the test food was screened and the percentage passing the ten-mesh screen was calculated. Fig. 8 shows that efficiency and pulverization of food at the swallowing point are somewhat related. There is a tendency for a child with low efficiency to be willing to swallow the imperfectly pulverized food that he obtains after the usual chewing effort.

SUMMARY

A partial analysis has been made of the factors which influence the chewing function of orthodontic patients. Certain general factors were considered, such as age, sex, numbers of posterior teeth in occlusion, food plat-

form area, maximum force, and side used in mastication. It was found that chewing ability was influenced by the presence of an appliance, and not related to the side preferred for mastication or to the sex of the patient. The age of the patient had a bearing on average chewing ability, but between the ages of 12 to 16 years there was no change in chewing ability among the patients studied. The numbers of posterior teeth in occlusion were an important influence on masticatory ability. The first premolar had little or no contribution to make to chewing ability. The first molar was observed to be the most important tooth for mastication, and appeared to be about equivalent to the combined value of one second molar and two premolars. There was a satisfactory correlation between the chewing ability with a soft food and a tough test food, indicating that a soft food can be used as an indication of masticatory ability for all foods. The pulverization of foods at the time of swallowing was related to chewing ability but the correlation was not as good as that found among adults. Low efficiency seemed to encourage swallowing of poorly pulverized food.

The authors appreciate the permission given by Dr. H. Margolis to make examination of patients of the Postgraduate Orthodontic Department and the advice given by him during the course of the work. Assistance with tests was provided by Mrs. Verna Tucker and Miss Madeleine Esserian, and aid in statistical treatment of data by Miss M. E. Dreisbach.

REFERENCES

1. Manly, R. S., and Braley, L. C.: Masticatory Performance and Masticatory Efficiency, J. D. Res. **29**: 448-462, 1950.
2. Manly, R. S., and Vinton, P.: A Survey of the Chewing Ability of Denture Wearers, J. D. Res. **30**: 314-321, 1951.
3. Abel, L. F., and Manly, R. S.: Masticatory Function of Partial Denture Patients Among Navy Personnel, J. Pros. Den. **3**: 382-392, 1953.
4. Shiere, F. R., and Manly, R. S.: The Effect of the Changing Dentition on Masticatory Function, J. D. Res. **31**: 526-534, 1952.
5. Unpublished study from this laboratory.
6. Hoffmeistr, F. S., and Manly, R. S.: Presentation at March Meeting of International Association for Dental Research, French Lick Springs, Indiana, 1951.
7. Manly, R. S.: Factors Affecting Masticatory Performance and Efficiency Among Young Adults, J. D. Res. **30**: 874-882, 1951.
8. Yurkstas, A., and Manly, R. S.: Value of Different Test Foods in Estimating Masticatory Ability, J. Appl. Physiol. **3**: 1, July, 1950.

TREATMENT PROBLEMS: THEIR ORIGIN AND ELIMINATION

ROBERT H. W. STRANG, M.D., D.D.S., BRIDGEPORT, CONN.

BY REQUEST, I have endeavored to prepare an article offering suggestions for avoiding errors in treatment and giving helpful methods of procedure when progress in corrective work is not satisfactory. Consequently, this article probably will be of little interest to those who have had years of experience in our field of endeavor. To the younger practitioners, I hope it will be of some help.

It has been my privilege to meet in the classroom more than 400 individuals, nearly all of whom have specialized in orthodontics for a period of five or more years. Almost all of these students have never been taught to use an organized method of case analysis for the purpose of preparing a detailed and coordinated plan of treatment. These men were carefully selected individuals. Most of them were theoretically well grounded, but lacked the essential ability to apply this theory to clinical practice. Consequently, I feel that it is absolutely necessary to open this presentation with the positive statement that a well-organized and purposeful preliminary analysis of every case of malocclusion is absolutely essential if treatment is to proceed with the minimum number of errors and complications.

What, then, are the essential details associated with case analysis as related to treatment requirements? For this procedure the working data are the history sheet, excellent models, intraoral radiograms, photographs, and oriented head radiograms.

The history sheet should tell the operator many pertinent facts upon which to base his prognosis and treatment planning. From this he should gain knowledge concerning the hereditary factors which often exert a definite influence upon the facial growth pattern of the patient, also upon muscular balance and nervous tension, and very positively upon caries susceptibility and Class III malocclusions.

The history data also will tabulate specific muscular perversions and muscular tonicity in the patient; they will indicate his nervous temperament, his general health, caries susceptibility, and oral hygiene habits. Endocrine influence may be in evidence.

The plaster casts must be studied with extreme diligence with the following objectives in view.

1. The Classification of the Malocclusion.—In spite of the fact that many orthodontists pay little attention to classification these days, I still hold to the

Read before The Northeastern Society of Orthodontists, Boston, Mass., Nov. 9 and 10, 1953.

belief that many important factors associated with successful treatment are revealed by the careful analysis that should be concomitant with determining the correct classification of every case. This analysis, as far as the models are concerned, includes a study of the inclined plane relationship; of the axial inclination of each tooth, with particular reference to that of the canine teeth of each denture; an analysis of the relationship of the interproximal line of the central incisors of the two dentures, later to be studied in the patient; and rotations of buccal teeth. Of these factors, I lay great stress on axial positioning as an indication of tooth shifting over basal bone. Inharmony of tooth material in the two dentures is sometimes in evidence and not infrequently do we find malformed teeth and variation in the size of right and left corresponding teeth.

2.—In this study of the models, the orthodontist must analyze the effect of missing teeth and prematurely lost deciduous teeth and the handling of this problem in treatment.

3.—In complicated cases, or in any case that presents an unsolved problem for treatment, a second set of models should be made and a so-called Kesling setup should be prepared.

Classification cannot be determined, however, by study of the plaster casts alone. The indications evolved from this analysis must be verified by the facial photographs and particularly by the oriented head radiograms. It is my contention that the relationship of the body of the mandible to the cranial portion of the head is the basic factor in establishing proper classification, and not the inclined plane relationship of the teeth.

4. Median Line Analysis.—I feel very certain that study of the relationship of the median lines of the two dentures to each other and to the midsagittal plane of the head is a factor in analysis that frequently is omitted. It has great importance in its relationship to treatment. The orthodontist must always remember that harmony in the median lines of the two dentures, as seen in the plaster casts, does not necessarily indicate that a normal condition exists. This denture area must be studied carefully on the patient. Harmony in the plaster casts may be present if there has been equal shifting of the incisors to the same side in both arches or if the maxillary teeth have shifted and coincidentally a condylar shift has taken place in the mandible; or there may be a shifting of the maxillary incisor teeth and a coincidental tooth and condylar shifting in the mandibular teeth. These variations can be detected and analyzed by examining the patient with the plaster casts as an aid. Detection and accurate analysis of such errors are imperative if proper correction is to be evolved and subsequently carried to completion.

5.—Another important factor to consider in studying the plaster casts is the degree of overbite. If this is excessive, the area of the denture at fault must be determined. This is an exceedingly important factor to ascertain for treatment planning.

6. Open-Bite Cases.—It has been my experience that the prognosis in open-bite cases is very unfavorable. This is not because they are difficult to treat,

for they are not. The secret of success lies in removing the cause, and in that essential detail I must admit a high percentage of failures.

Probably the most prevalent cause is a perverted muscular habit, most frequently associated with tongue-thrusting during swallowing. This is a most difficult habit for the patient to overcome, no matter how cooperative and conscientious he may be.

In a few of these tongue thrusters, I have found anesthesia of the oral pharynx. This should always be suspected and can be detected by touching the pharyngeal walls with the mouth mirror. There will be complete absence of gagging.

In other cases, there is found an abnormal growth pattern of the mandible. The vertical growth of the rami has not been in coordination with the vertical growth of the alveolar process. In these cases the only teeth in contact are the molars, and, with the eruption of each succeeding molar, the bite opens to a greater degree. Inheritance of this faulty growth pattern can at times be detected.

7.—Finally, note the effect of muscular pressure upon the denture form. Excessive pressure of certain groups of muscles, either from habit contraction or hypertonicity, is definitely registered, in most cases, by tooth positioning and denture form.

I cannot emphasize too strongly the fact that a denture in malocclusion is a denture in muscular balance, and treatment planning must take this into consideration. If this inherent muscular balance is violated in corrective procedures, the stability of the final result is proportionately jeopardized.

The intraoral radiograms are now studied to ascertain abnormalities.

The photographs give some indication of the position of the mandible in relation to the cranium and hence are used to verify deductions in classification previously evolved from model analysis.

Esthetics, of course, is an important part of this study, and treatment planning must take this into serious consideration. Here the question of facial deformity from protrusive dentures, Class II or Class III malocclusions, enters the field of preliminary study.

The oriented head radiograms reveal so clearly the osseous foundation of the dentures that they are absolutely essential in this preliminary study of each case, if accuracy in treatment planning is to be acquired.

Of the many papers outlining methods of clinical study of these radiograms, that have been presented, the one by Dr. William B. Downs, appearing in the October, 1948, AMERICAN JOURNAL OF ORTHODONTICS, seems to me to be the most comprehensive and practical from a clinical viewpoint.

Drs. Jack M. Vorhees and J. William Adams have presented, in the *Angle Orthodontist*, for October, 1951, a method of graphically illustrating the Downs recordings, using the Hellman so-called "wiggle" idea. This is a comprehensive method of visualizing the Downs data in relation to the extremes of normal and, by the use of this diagram, the entire record can be seen at a glance.

The very fact that such a systematic analysis of each case requires considerable time brings up another reason why the orthodontist may be confronted with serious complications as treatment progresses. This requirement necessitates the limitation of the number of cases that can be accepted for treatment each year. Far too many men are overloading their working hours and do not have the time to make a careful preliminary study of each case. I do not believe that it is possible for the average operator to accept more than fifty new cases each year and do justice to each individual patient. In an overloaded practice there is no time for preliminary analysis of new cases or for appointments of sufficient duration to make the essential appliance adjustments to maintain accurate and progressive tooth movements.

Having thus completed such a well-organized and routine plan of analysis of the malocclusion for the purpose of classification, the operator, coincidentally, has gained definite information concerning the variations from normal of crown and root positioning of individual teeth and of each denture as a composite unit. He is then in a strategic relationship to his case for outlining the details of treatment.

How impractical it would be if all this knowledge were allowed to go to seed because it was not recorded in written form! Consequently, it is imperative, if errors are to be avoided, that the requirements of treatment, as disclosed in this preliminary analysis, be coincidentally placed on a record card for reference each time the patient appears.

The deductions having been made that individual teeth or groups of teeth must be moved in certain directions, that axial positions must be changed, that the median line disharmony must be corrected in a certain manner by either tooth shifting or condylar change, that the excessive overbite must be overcome by changes in selected denture areas, that rotations of various teeth are required, that denture relationships must be brought back to normal or that teeth must be extracted as a treatment necessity, the orthodontist must record, in logical sequence, the appliance manipulation by which these changes are to be accomplished.

It is not the purpose of this article to expound the virtues of any particular appliance and hence no appliance will be mentioned by name. When an operator has detailed, in written form, the specific requirements of treatment, it is most certain that he must select an orthodontic mechanism of sufficient efficiency to effect these stipulated tooth and denture modifications. Common sense answers the question of the choice of appliance. Furthermore, complete mastering of appliance application and subsequent modifications as required for specific tooth movements are essential qualifications if errors in treatment are to be avoided.

Having completed all these specified details of treatment planning up to this stage, an exceedingly important decision for success now confronts the operator. What are the so-called anchorage potentialities for use in the production of treatment specifications?

One of the prevalent causes of errors in treatment has its origin in anchorage failure. Although we frequently use the term *stationary anchorage,* such an anchorage in the oral cavity is a myth. All teeth subjected to forces of displacement will move, unless they are ankylosed. Therefore, the operator must devote serious thought to this problem of anchorage. Treatment in many cases must be delayed until certain teeth have erupted to serve as units in the anchorage setup. Often the primary tooth movement in treatment is devoted to anchorage preparation instead of corrective activities.

In the days when denture expansion was in vogue, anchorage problems were not so acute because nearly all teeth were involved in the so-called reciprocal movement. Now, if we are to produce a stabilized result, we avoid denture expansion, which means that anchor dental units usually must be moved as little as possible. Reciprocal tooth movement is seldom indicated today.

Proper anchorage is obtained in three ways: first, by pitting groups of teeth against individual teeth; second, by an appliance adjustment which assures bodily displacement of anchor units if they are to move and a tipping tooth movement of the tooth to be moved; and, third, by intermaxillary elastic or extraoral support of the group of anchorage teeth.

Sometimes there are factors present that cause failure of well-prepared anchorage. One of the common factors is occlusal interference with the tooth to be moved. Excessive overbites, high, sharp cusps, and lingual occlusion of maxillary teeth are in this category. The insertion of a bite plate solves this problem.

In the movement of canines distally into spaces provided by the extraction of first premolars, the operator may see the space closing to his great satisfaction, only to awaken later to the realization that most of the space closing has been due to the forward movement of the anchor teeth instead of the required distal movement of the canines. Failure to include second molar anchorage, as well as first molar and second premolar teeth, is probably at fault here. Often it is wise to delay treatment until the second molars have erupted. Extraoral anchorage may need to be incorporated in the appliance setup to save the situation. Here again, the operator should look for cuspal interference associated with locking of the canine and insert a bite plate, if that is the case.

Perhaps the appliance adjustment is producing a depressing action, as well as a tipping action, on the canine. In uprighting a mesially tipped canine, the force applied should tend to elevate the tooth, as well as tip it upright.

Frequently, errors arise as a result of attempting to align or rotate a tooth before there is sufficient denture space provided for this movement. This indicates that the sequence of tooth movement is at fault. The evolvement of space always comes primarily and the tooth movement secondarily.

An error that may be attended with dire results is associated with the labial movement of maxillary lateral incisors at a time when the unerupted crowns of the canines are overlying the roots of these lateral incisors. Radiograms readily reveal this condition and superficial indeed has been the study

if this association of dental units has been missed. The roots of the lateral incisors are in danger of being destroyed by contact with the canine crown in tooth movement. Relocating the lateral incisors must be delayed until the eruption of the canines has taken place and sufficient space subsequently provided for the lateral incisors.

The attempted lingual movement of maxillary incisors in deep overbite cases, in which there is contact between the mandibular incisors and the gingival area of the maxillary incisors, is another common error, strange as it may seem. Correction of the overbite must come primarily and the incisor movement secondarily.

That brings to mind the problem of correcting excessive overbites, which is a knotty one that readily leads to errors. To avoid mistakes, the operator must make careful analysis of the malocclusion to determine the denture area or areas involved in the production of this condition.

There are three important guideposts in models of malocclusion with excessive overbites, which give an indication of what the prognosis should be and what treatment will gain success and avoid errors.

The first of these significant factors is an exaggerated curve of Spee, more clearly detected in the mandibular denture. In such a case the prognosis is good and final stability is quite certain if in treatment the molars are uprighted, the incisors depressed, and the premolars elevated. Most vital in effecting such tooth movements is mandibular second molar anchorage.

The second of these guideposts is supraocclusion of maxillary and mandibular incisors associated with good vertical growth of the face in the denture area. Again the prognosis is excellent. The treatment in such a case is depression of these supraoccluding incisors.

An error is made in the treatment of either of these two types of excessive overbites if a bite plate is used for corrective procedures. As long as the bite plate remains in position, progress seems satisfactory, but when the plate is removed, collapse of the elevated buccal teeth takes place because muscle balance in the vertical plane has been violated.

The third guide to prognosis and treatment in excessive overbite cases is found most frequently in Class II, Division 2, malocclusion, but may occur in Class I. In this type the mandibular buccal teeth appear partly erupted, while the mandibular incisors have erupted to a much higher plane. Associated with this condition is a decided lack of vertical growth in the oral area of the face. The prognosis here is poor and, while a bite plate will temporarily overcome the overbite, final stability usually is unattainable. An error is made by any operator who assures a good result, as far as permanent correction of the overbite is concerned. The mesiodistal variation can be corrected and stabilized, but not the corrected overbite.

Errors are frequently associated with the correction of inharmony of the median denture lines. The plan for treatment of these cases cannot be evolved from an analysis of the models alone. Like overbite cases, close study of the patient must be included in this analysis. The operator must determine the following facts.

1. Which median denture line, if either, is in harmony with the midsagittal plane of the head?

2. If the maxillary median line is at fault, then one can be certain that the incisor teeth have shifted toward the side of variation. On the other hand, if the maxillary median line is correctly adjusted to the midsagittal plane and the variation is in the mandibular denture, then the operator must ascertain whether the inharmony is due to tooth shifting, condylar displacement, or both.

Tooth shifting is diagnosed by faulty axial inclination of the incisor teeth, by loss of canine space on the side toward which the teeth have moved, and by the inclined plane relationship of the buccal teeth. Condylar displacement, on the other hand, is checked by the presence of lingual occlusion of the maxillary buccal teeth on the side away from the displacement, by inharmony of the facial lines, by the chin being thrown toward the side of displacement and slightly prominent, and by having the patient slowly open and close the mouth. At one stage in the downward movement of the mandible, the median line will automatically correct itself and then, in closing, the inharmony again will suddenly register itself.

It is well to mention at this time that not all cases of malocclusion with lingual occlusion of the maxillary buccal teeth on one side exhibit inharmony of the median lines of the two dentures or are associated with a condylar shift. Furthermore, there may be a unilateral condylar shift without the presence of lingual occlusion of the maxillary buccal teeth. This latter maladjustment occurs in cases in which the maxillary buccal teeth have shifted forward on one side and the patient coincidentally moves the mandible forward on this side to maintain better functional efficiency.

3. If there is harmony of the median line of the two dentures, is this median line in harmony with the midsagittal plane of the head?

I am quite certain that the importance of analyzing the mid-line relationship of the dentures to each other and to the midsagittal plane of the head is not appreciated by the less experienced orthodontists and is entirely ignored by the careless and superficial operator in our special field. Consequently, this oversight can be tabulated as the cause of a great many errors in treatment. Under correct treatment, a condylar shift in a patient who has not reached adult age will automatically correct itself because the proper change in tooth relationship will dictate the necessity for a normal relationship of the condyle in the mandibular fossa in order to maintain functional efficiency. Of course, if the patient is of such an advanced age that the structure of the joint has become modified by years of functioning in this abnormal location, the automatic correction probably will not take place.

On the other hand, if the treatment plan is based upon the faulty deduction that condylar relationship is correct, then serious complications are bound to appear during the course of the corrective procedure.

Another complication in malocclusion which may lead to errors in treatment is the presence of lingual occlusion of the maxillary buccal teeth on one

side of the denture. The operator must decide whether this is to be corrected by unilateral expansion of the maxillary denture or by bilateral expansion force.

In making the correct decision, the relationship of the median lines of the two dentures to each other and to the midsagittal plane of the head is again a factor of great value. The following rules should be born in mind.

1. Bilateral expansion of the maxillary dental arch is indicated in unilateral lingual occlusion when the interproximal space between the central incisors of the *mandibular* denture is deflected from the median sagittal plane of the skull in a direction that is toward the side on which the lingual occlusion of the maxillary buccal teeth is present.

2. Unilateral expansion of the maxillary dental arch on the side of lingual occlusion is indicated when the interproximal spaces between the central incisors of both dental arches show proper harmony with one another or very little variation therefrom, and also are in harmony with the midsagittal plane of the skull.

3. Unilateral expansion is also indicated when the maxillary median line has been deflected to one side by a forward shifting of the buccal teeth of the side away from which the median line had moved and when these teeth are also in lingual occlusion, as well as displaced forward.

These are some of the pitfalls that lead to mistakes in treatment. No one is immune to them. Mistakes are the things from which we gain wisdom. Someone has said, "Knowledge is what you learn from others; wisdom is what you teach yourself." It is not such a tragic fault to make a mistake for the first time. It is tragic to continue to make the same mistake time and time again.

Consequently, if the orthodontist finds that an error has crept into his plan of treatment, what should he do? The first thing is to stop treatment at once, take off the arch wires, take study models and evaluate the situation by a comparison of the study models with the models of the original malocclusion.

Anchorage failure usually can be detected by a change in the axial position of the anchor teeth. They are likely to be tipped toward the teeth that are to be moved. If the operator has built up anchorage stability by all teeth available and added extraoral anchorage, the patient may be at fault by not cooperating in the wearing of the intra- or extraoral auxiliary. If second molar teeth were not incorporated, certainly they should be and, if they have not erupted, treatment should stop until they have come into position.

Occlusal interference with the tooth to be moved should be carefully checked. The position of the bands on all teeth should be studied. An error in the location of the buccal sheath on the molar can cause a great deal of trouble and readily upset anchor stability. The arch wires should be examined. If they have lost their resiliency, this may be the answer.

The force that is being exerted by the appliance adjustment should be analyzed carefully. Arch wires are frequently bent and distorted by masticatory

stress or by uncooperative patients. Rotating devices become inactive for various reasons.

In rotating a tooth with efficiency, there must be two forces in action, one on the mesial side and the other on the distal side of the tooth, so that there will be a push and pull action coincidentally, each in the correct direction of required movement. Furthermore, sufficient space must be present to accommodate the rotating tooth.

Overtreatment of rotated teeth, of closed bites, and distal movements of buccal teeth should be the rule. There is almost invariably a rebound, as it were, to every form of tooth movement and it is a mistake not to take this into consideration as the end of treatment is approached.

Muscular pressure, in the form of a habit, may be stronger than the force delivered by the appliances.

A new set of radiograms may disclose an unerupted tooth blocking the desired tooth movement. This is particularly the case in buccally displaced maxillary second molars, due to the crowding forward of developing third molars. In such a contingency, it is good treatment to extract the bucally displaced second molar and allow the third molar to take its place. Otherwise, the force required to reposition the second molar may move the buccal teeth forward, instead of pushing the third molar distally, and upset all advancement previously gained.

Finally, do not hesitate to consult with a more experienced associate. It is no disgrace to acknowledge inability to solve a problem of this kind and to seek aid in consultation. The patient's welfare is of prime importance and the parents will hold you in high regard if you are man enough to admit that you need help and take all means available to obtain that aid. You, in turn, will be the one to profit most by the advice of the older contemporary.

In conclusion, I would summarize the most prevalent causes for errors in treatment, as follows:

1. Superficial and unorganized analysis of the case previous to beginning treatment.

2. Failure to prepare a written step-by-step plan of appliance manipulation.

3. Overloading the practice with too many patients.

4. Inefficient mechanism to perform all tooth movements required for successful treatment.

5. Failure to master the technique associated with the use of an efficient appliance.

6. Improper sequence of tooth movements.

7. Attempting to move teeth that are stabilized by occlusal interference or lack of denture space.

8. Insufficient anchorage control.

9. Failure to correctly analyze and subsequently treat excessive overbites and median-line inharmonies.

10. Violation of the inherent muscular balance.

11. Inability to gain the cooperation of the patient.

To the less experienced operator, however, I would like to leave this word of encouragement. As old and as experienced as many of us are, we still make mistakes and, as a result, errors creep into our carefully planned procedures in treatment. Fortunately, the wisdom gained by years of clinical practice enables us to detect and eliminate the errors more quickly, as well as reduce the frequency of their occurrence.

In orthodontics, as in all specialties, there is no easy road to success. Basic theory must be mastered and continually kept up to date by studying. Office routine must be well organized so that there will be time available for careful and thorough attention to every case under treatment. Objectives such as social engrandizement and high financial intake, at the sacrifice of efficient service, are not conducive to professional advancement. Only by brain and manual training can errors be of minimum percentage and stabilized results routinely attained, but the reward is worth the effort.

114 State St.

CHANGES IN THE MANDIBULAR CONDYLES OF MICE FOLLOWING THE USE OF ORTHODONTIC BITE PLATES

EDMUND APPLEBAUM, D.D.S., AND HENRY P. LEVY, D.D.S., NEW YORK, N. Y.

INTRODUCTION

THERE is a voluminous amount of literature on normal and abnormal changes in the form and function of the temporomandibular joint. The following references, however, are particularly relevant to this article. Levy[1] made systematic histologic studies of the growth changes in the temporomandibular joints of normal mice. This work established a standard for his later studies of the effect of dietary deficiencies on the growth of the mandibular condyle.[2] Weinmann[3] showed rachitic changes, while other workers[4] showed the effects of severe phosphorus deficiency on the condyle of the rat. Breitner[5] showed changes in the temporomandibular joints of young monkeys following the use of an orthodontic bite plate cemented to the teeth. He interpreted the bone changes in terms of altered mechanical forces. The effects of various disturbances, such as the loss of posterior or all teeth,[6, 7] ankylosis,[8] and arthritis,[9] also have been described. Several workers have emphasized the importance of genetic and endocrine factors[10] on the form of the joint, and others have described modification of mandibular architecture following removal of the temporal muscle in the rat.[11]

Our object in this study was to investigate the histologic changes in the condyles of growing mice following the use of a small cast-gold bite plate.[12] Our particular interest was to determine whether the changes in the developing temporomandibular joints were due to the mechanical effect of the bite plate or to the malnutrition resulting from impaired mastication.

METHODS AND MATERIALS

The initial problem was to devise a bite plate for the experimental mice. The bite plate construction involved the sacrifice of a mouse of the same age as the experimental animal. The mandible was removed to facilitate impression taking of the tooth and palate area of the maxilla. A wax pattern of the area covering the molar teeth, palate, and incisor teeth was invested and then cast in gold. All the castings were at least 1 mm. thick. To insert and cement the appliance on a mouse, it was necessary to immobilize the animal on a dissection board. An intraperitoneal injection of 0.4 to 0.5 c.c. of 0.2 per cent Nembutal 1 was used to obtain anesthesia. The bite plate was inserted into the animal's mouth, using a moderately thin mix of cement. The appliance then was held in position under light pressure until the cement was set.

From the Department of Anatomy, School of Dental and Oral Surgery, Columbia University, New York, N. Y.

Fourteen young Swiss mice with actively growing temporomandibular joints were selected for the experiments. One group of mice was 10 weeks old, another was 7 weeks, and a third was 4 weeks old at the start of the experiments. All the mice, except their controls, had bite plates cemented to the upper molar area for varying periods of time (about one to three weeks). The mice were arranged into the following three groups on the basis of feeding technique and age.

First Group: Two mice (10 weeks old) with bite plates in position, were placed on an adequate routine (solid) diet for three weeks. The food mixture (Rockland Rat Diet) was freely available. Milk was also fed to them periodically with an eye dropper (6H,7H).

Second Group: Five mice which were 7 weeks old at the start of the experiment were fed a balanced liquid diet[13] for three weeks. All these mice were fed the liquid diet with an eye dropper. Three control mice (14H) and one mouse (16H) with a bite plate in position were fed this liquid diet for three weeks. Another mouse (15H) with a bite plate in position for one week was then permitted to recover for the remaining two weeks of the experiment by the removal of the bite plate.

Third Group: Three litter mates, 7 weeks old, were used. A mouse with a bite plate in position (8K) and its pair-fed control (9K) were both fed the same amounts of a liquid diet. A third (ad libitum) control mouse (10K) was allowed to partake freely of the liquid diet. Two weeks later all these mice were sacrificed.

Four litter mates, 4 weeks old, were used. One mouse with a bite plate in position (1K) and its pair-fed control (2K) were fed the same amount of the liquid diet. Two other (ad libitum) control mice (3K,4K) were allowed to partake freely of the liquid diet. All these mice were sacrificed after five days on the liquid diet.

The heads of all the mice were prepared for histologic study in the manner described by Levy.[1] Serial sections were cut in the frontal plane and stained with hematoxylin and eosin. The photomicrographs were taken at the same magnification with 16 mm. objective and Homal VI eyepiece (Zeiss) for comparison of the condylar changes in the three experimental groups.

FINDINGS

Fig. 1 is a photomicrograph of the temporomandibular joint of a typical control mouse (14H). It was given a routine diet and was 10 weeks old when sacrificed. Note the thick, rounded cartilage cap on the mandibular condyle, with the characteristic layers of cartilage cells seen at this stage of development. Near the articular surface, the zone of young, proliferating cartilage cells are thin or flattened, while deeper in the cartilage cap the maturing cartilage cells are rounded, enlarged, and separated by the intercellular cartilage matrix. Still deeper is the zone of calcifying cartilage. Osteogenesis is active here with bone deposition on the cartilage columns. This results in the forma-

Fig. 1.

Fig. 2

Fig. 3.

Fig. 1.—Mandibular condyle of a control mouse, ten weeks on a routine (solid) diet. (Magnification, ×110; reduced ⅓.)

Fig. 2.—Mandibular condyle of a mouse, 10 weeks old, on a routine diet with bite plate in position for three weeks. (Magnification, ×110; reduced ⅓.)

Fig. 3.—Mandibular condyle of a mouse, 7 weeks old, on a liquid diet with bite plate in position for three weeks. (Magnification, ×110; reduced ⅓.)

tion of longitudinal bony trabeculae with cartilage cores. We can also note the consolidation of bone trabeculae with restriction of marrow spaces in the ramus of the growing mandible.

Fig. 2 is a photomicrograph of the temporomandibular joint of a mouse with a bite plate (7H). It was 10 weeks old at the start of the experimental period, which continued for three weeks. A cast-gold bite plate was inserted while the animal continued on the routine diet. This mouse had difficulty in chewing the solid diet and lost weight (25 per cent). Note the thinner cartilage cap on the condyle as compared with that in Fig. 1. There are fewer cells in the cartilage cap and the different zones are compressed. Larger marrow spaces are seen in the developing bone.

Fig. 3 is a photomicrograph of the temporomandibular joint of another mouse with a bite plate (16H). It was 7 weeks old at the start of the experimental period, which continued for three weeks. A cast-gold bite plate was inserted while the animal was put on a liquid diet. This mouse did not lose so much weight as the one in Fig. 2. There is a slight improvement in the appearance of the condyle over that seen in Fig. 2 on the routine (solid) diet. Another mouse in this group (15H) had an appliance on for one week and then it was removed for the remaining two weeks of the experimental period. This mouse gained weight and its condyle looked like that of a normal control as in Fig. 1.

Evidently nutrition played a role in the temporomandibular joint changes of these mice, in addition to the mechanical role of the bite plate. To further differentiate between the effects of the various forces involved, we instituted pair-feeding of several littermate mice with and without bite plates. A mouse with a bite plate was put on a liquid diet, and for comparison a pair-fed control mouse (without a bite plate) was given the same amount of the liquid diet. We also had an ad libitum control animal which was allowed to partake freely of the liquid diet.

Fig. 4 is a photomicrograph of the temporomandibular joint of an ad libitum control mouse (10K). It was 7 weeks old at the start of the experiment and was allowed to partake freely (ad libitum) of a liquid diet for an additional two weeks. Note the normal thickness and roundness of the cartilage cap of the condyle, for this stage of development.

Fig. 5 is a photomicrograph of the temporomandibular joint of a pair-fed control mouse (9K). It was 7 weeks old at the start of the experiment and then was fed the same amount of a liquid diet as consumed by the mouse with a bite plate, for an additional two weeks. Note the reduced thickness of the cartilage cap of the condyle, as compared to that of the ad libitum control mouse seen in Fig. 4.

Fig. 6 is a photomicrograph of the temporomandibular joint of a mouse with a bite plate (8K). It was 7 weeks old at the start of the experiment and then was fed a liquid diet for an additional two weeks while wearing the bite plate. Note the reduced thickness of the cartilage cap of the condyle when compared to that of Fig. 4 and the similarity to its pair-fed control in Fig. 5.

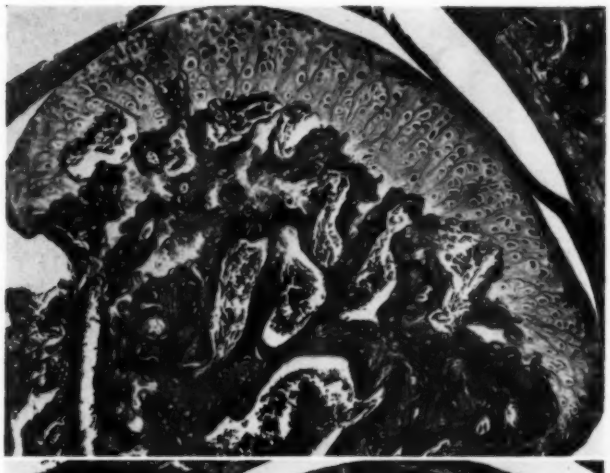


Fig. 4.

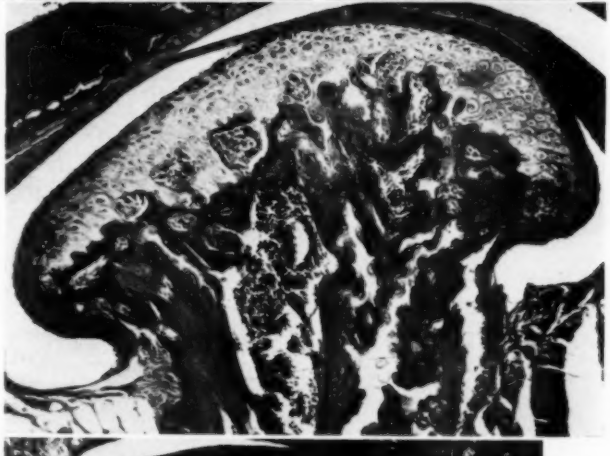


Fig. 5.

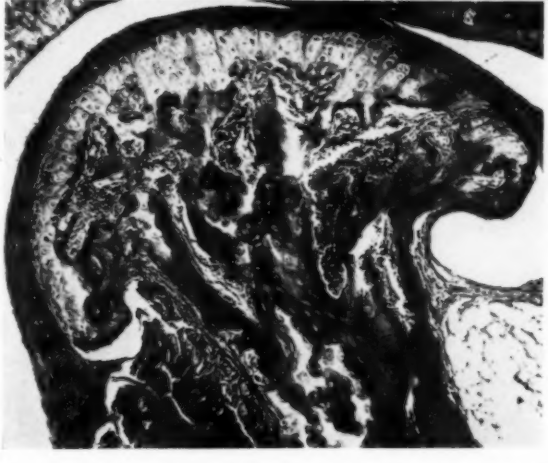


Fig. 6.

Fig. 4.—Mandibular condyle of ad libitum control mouse, 7 weeks old, allowed to partake freely of a liquid diet for two weeks. (Magnification, ×100; reduced ⅕.)

Fig. 5.—Mandibular condyle of pair-fed control mouse, 7 weeks old, fed same amount of liquid diet as a mouse with bite plate for two weeks. (Magnification ×100; reduced ⅕.)

Fig. 6.—Mandibular condyle of a mouse, 7 weeks old, fed a liquid diet for two weeks while wearing a bite plate. (Magnification, ×100; reduced ⅕.)

Fig. 7.

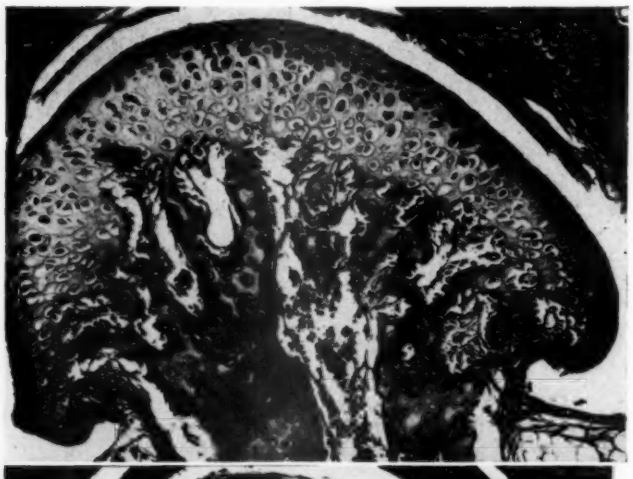


Fig. 8.

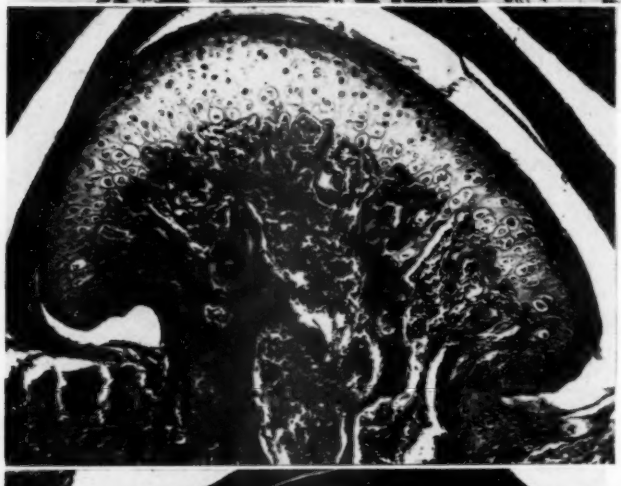


Fig. 9.

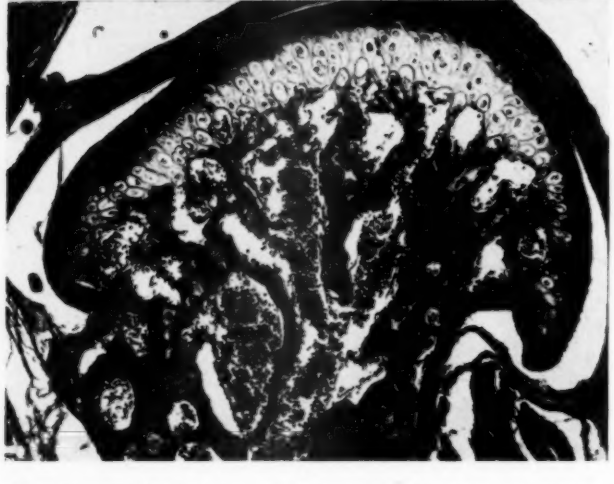


Fig. 7.—Mandibular condyle of ad libitum control mouse, 4 weeks old, fed liquid diet freely for five days. (Magnification, ×100; reduced ⅕.)

Fig. 8.—Mandibular condyle of pair-fed control mouse, 4 weeks old, fed same amount of liquid diet as a mouse with bite plate for five days. (Magnification, ×100; reduced ⅕.)

Fig. 9.—Mandibular condyle of a mouse, 4 weeks old, fed a liquid diet for five days while wearing bite plate. (Magnification, ×100; reduced ⅕.)

Fig. 7 is a photomicrograph of the temporomandibular joint of an ad libitum control mouse (4K). It was 4 weeks old at the start of the experimental period and then was allowed to partake freely of a liquid diet for five days. Note the normal thickness and roundness of the cartilage cap of the condyle for this stage of growth and development.

Fig. 8 is a photomicrograph of the temporomandibular joint of a pair-fed control mouse (2K). It was 4 weeks old at the start of the experiment and then was fed the same amount of the liquid diet as consumed by the mouse with a bite plate, for five days. Note the reduced thickness of the cartilage cap of the condyle as compared to that of Fig. 7 (the ad libitum control mouse).

Fig. 9 is a photomicrograph of the temporomandibular joint of the mouse wearing a bite plate (1K). It was 4 weeks old at the start of the experiment and was fed a liquid diet for five days with a bite plate. Note the reduced thickness of the cartilage cap of the condyle, as compared to that of Fig. 7 (the ad libitum control mouse), and the similarity to its pair-fed control in Fig. 8.

DISCUSSION

Fig. 2 shows a reduction in the normal thickness of the cartilage cap of the condyle of a 10-week-old mouse. It was kept on a routine (solid) diet for three weeks with a bite plate in position. Fig. 2 can be explained as the result of the mechanical (orthodontic) effect of a bite plate, but this condylar change is similar to that resulting from a diet deficient in pantothenic acid, as described by Levy.[2] Thus, the condylar changes in Fig. 2 may be due to the effect of poor nutrition. Furthermore, it is to be noted that this mouse lost weight (25 per cent), presumably due to interference with chewing by the bite plate.

Therefore in the second group, two mice with bite plates and three control animals were placed on an adequate liquid diet.[13] The control mice all gained weight and one mouse wearing a bite plate (16H) at least did not lose weight. The condyle of this mouse, seen in Fig. 3, looked slightly better than the condyle of the mouse on a routine (solid) diet as seen in Fig. 2. One mouse (15H) on the liquid diet had a bite plate in place for one week and did not gain weight, but when the appliance was removed, the animal began to gain weight (10 per cent) and its condyle, on sectioning, looked perfectly normal. Evidently, the difficulty in obtaining nourishment with the bite plate in position was related to the changes seen in the condyles of the mice with bite plates.

Next, pair-feeding was instituted in the third group, to further differentiate between the mechanical effects of the bite plate and the nutritional effects of a decreased intake of food on mice from the same litter. A mouse with a bite plate was put on a liquid diet and for comparison a pair-fed control mouse without a bite plate was given the same amount of liquid diet. As a final check, we allowed a mouse to partake freely of the liquid diet—the ad libitum control. Three litter mates, 7 weeks old, were used. The amount of liquid food given to the pair-fed control mouse was determined by the quantity taken

daily by the mouse with bite plate in position. There was also an ad libitum control which was allowed to partake freely of the liquid diet. The condyle of this ad libitum control animal is seen in Fig. 4 and has a thick cartilage cap. Figs. 5 and 6 show the respective condyles of the pair-fed control mouse and the mouse with a bite plate. The cartilage caps in both these figures are thinner than that in Fig. 4.

The fact that Fig. 6, showing the condyle of the mouse with a bite plate, is similar to Fig. 5, showing the condyle of the pair-fed control mouse, indicates that nutritional factors played a dominant role in altering the shape of the condyle of these mice.

The changes in the 4-week-old mice on the liquid diet for five days (Figs. 8 and 9) were not quite as marked as the 7-week-old mice on this diet for three weeks (Figs. 5 and 6). Nevertheless, there is a definite difference between the condyle of the 4-week-mouse with a bite plate (Fig. 9) and that of its ad libitum control mouse (Fig. 7.)

SUMMARY

It has been demonstrated in several ways that the form of the developing mandibular condyle of the mouse is influenced not so much by the mechanical effect of a bite plate as by malnutrition resulting from impaired mastication.

REFERENCES

1. Levy, B. M.: Growth of Mandibular Joint in Normal Mice, J. Am. Dent. A. **36**: 177; 1948.
2. Levy, B. M.: Effects of Pantothenic Acid Deficiency on Mandibular Joint and Periodontal Structures of Mice, J. Am. Dent. A. **38**: 215, 1949.
3. Weinmann, J. P.: Rachitic Changes of Mandibular Condyle of the Rat, J. D. Res. **25**: 509, 1946.
4. Coleman, R. D., Becks, H., Copp, D. H., and Frandsen, A. M.: Skeletal Changes of Severe Phosphorus Deficiency in the Rat, Oral Surg., Oral Med., and Oral Path. **6**: 756, 1953.
5. Breitner, Carl: Further Investigations of Bone Changes Resulting From Experimental Orthodontic Treatment, AM. J. ORTHODONTICS **27**: 605, 1941.
6. Rogers, W. M., and Applebaum, E.: Changes in the Mandible Following Closure of the Bite With Particular Reference to Edentulous Patients, J. Am. Dent. A. **28**: 1573, 1941.
7. Riesner, S. E.: Temporomandibular Reactions to Occlusal Anomalies, J. Am. Dent. A. **25**: 1938, 1938.
8. Blair, V. P.: Consideration of Contour as Well as Function in Operations for Ankylosis of Lower Jaw, Surg., Gynec. & Obst. **46**: 167, 1928.
9. Bauer, W. H.: Osteo-arthritis Deformans of the Temporomandibular Joint, Am. J. Path. **17**: 129, 1940.
10. Todd, T. W.: Facial Growth and Mandibular Adjustment, INT. J. ORTHODONTIA **16**: 1243, 1930.
11. Horowitz, S. L., and Shapiro, H. H.: Modifications of Mandibular Architecture Following Removal of Temporalis Muscle in the Rat, J. D. Res. **30**: 276, 1951.
12. Levy, H. P.: Tissue Changes Upon the Application of Force on a Molar, AM. J. ORTHODONTICS **37**: 144, 1951.
13. Levin, L.: The Relation of Food Consumption Hypophysis and Adrenal Cortex to Serum Albumin Metabolism in the Rat, Am. J. Physiol. **138**: 258, 1943.

PRESENTATION OF THE ALBERT H. KETCHAM MEMORIAL AWARD, 1954, BY RAYMOND L. WEBSTER, PRESIDENT OF THE AMERICAN BOARD OF ORTHODONTICS

Mr. President, Dr. Baker, Fellow Directors of the American Board of Orthodontics, Members of the American Association of Orthodontists, and Guests:

Of all the pleasant duties that befall the President of the American Board of Orthodontics, none is greater than the privilege of representing the American Association of Orthodontists in bestowing our highest honor, the Albert H. Ketcham Award. This memorial was created in 1936, the year following the death of Dr. Ketcham, to commemorate his outstanding achievements and to serve as an inspiration to the advancement of orthodontics. Today we are honoring a man whose life should serve as an inspiration to the young men just entering orthodontics; a man who, in this day and age, has unusual and rare qualities; a quiet, unassuming gentleman with a kindly smile and a willingness to serve; a man whose friends are legion.

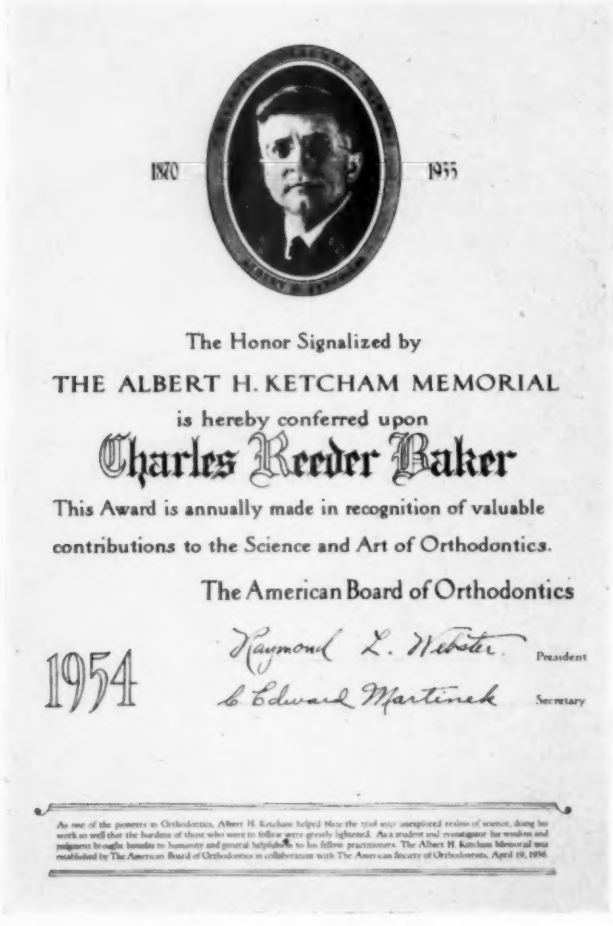
Dr. Charles Reeder Baker was born April 8, 1880, at Lansing, Illinois, the son of Francis R. and Luanna Huff Baker. Dr. Baker's father was a Civil War veteran who, for nearly fifty years, was station agent for the Pennsylvania Railroad. At the age of 13 his son, Charlie, was a capable telegraph operator, handling telegrams and train orders. Even at the age of 12 years, as quoted from his words: "I acquired the job of taking care of five switch lamps, and was very proud each month to step into the railroad pay car and receive my salary of $5.00 from the paymaster."

Upon graduation from grammar school, Dr. Baker entered the Chicago Business College, where he completed a business and stenographic course and was therefore able to be appointed assistant to his father with the salary of $10.00 per month, which was in addition to the $5.00 per month for the switch lamp job.

In 1896, at the age of 16, he began working as a stenographer for the Carter White Lead Company. His office hours were from 8 A.M. to 6 P.M. six days per week and the salary was $6.00 per week. After several years, he says, "My pay grew to $11.00 per week and during these years I paid my railroad fare, gave my mother money for my board, and put $5.00 per month into a building and loan association." Later he worked for the Adams Express Company in Chicago and in one day wrote 180 dictated letters, breaking the office record. As if he didn't have enough to do, I find that in 1899 he took violin lessons at the Chicago Musical College and played first violin in a small orchestra for several years.

An item in Charlie's diary, dated April 11, 1899, reads: "Have made up my mind to be a dentist." May I pause for a moment at this point to reflect

upon how a young man nowadays reacts to this decision. In most instances, he has been helped with his education by his parents and knows that he will continue to be helped by them. Dr. Baker was then 19 years old, and had been on his own since 16 years of age.


1870
1955
The Honor Signalized by
THE ALBERT H. KETCHAM MEMORIAL
is hereby conferred upon
Charles Reeder Baker
This Award is annually made in recognition of valuable
contributions to the Science and Art of Orthodontics.
The American Board of Orthodontics
1954
Raymond L. Webster President
Edward Martinek Secretary

THE KETCHAM AWARD

Upon learning that he could qualify for admission to the Northwestern University Dental School, he studied the *Bulletin* of the school, carefully noting the list of expenses covering tuition, laboratory fees, instruments, books, etc., adding estimates for carfare ($5.40 per month), lunches (at 15 cents), and incidentals. He decided that his equity in the building and loan association, which now amounted to $185.00, would carry him through the first two years of school. Later he was greatly perturbed to find that this fund did not quite cover expenses for the first year. His father, who earned only a modest salary, helped him on many occasions and Charlie worked as a stenographer each vacation period.

As the dental school did not use textbooks on chemistry during the freshman year (the professor read his lectures and the students copied his remarks

verbatim), our industrious member took the first lecture in shorthand, rushed over to the linotype operator and had printed copies for sale to his classmates the following day at 10 cents per copy. "The only purchasers," says Charlie, "were three foreign students who had difficulty with the English language, so this venture was decidedly a financial failure."

At the beginning of the next school year he joined up with a senior student and obtained the agency for the Chicago Medical Book Company. During the first month of school they sold textbooks, compends, notebooks, and fountain

CHARLES REEDER BAKER

pens to many of the 600 students at the school. While this prevented him from working in the prosthetic laboratory for several weeks, it proved to be successful financially. A few weeks later he was engaged to report stenographically one lecture per week on materia medica and two lectures per week on special pathology and therapeutics. This meant that on three evenings each week, after reaching home at 7:30, he had to transcribe on a rented typewriter the notes he had taken so that he could turn the copy in, ready for the printer, at 8:00 o'clock the following morning. The material was printed and made available to all the students. The money earned helped considerably to pay expenses, but he learned later that he had not charged enough for his services.

In 1903 Dr. Baker graduated from Northwestern University Dental School and received a D.D.S. degree. The following morning he received his license from the Illinois State Board of Dental Examiners, had it recorded in the courthouse, and went directly to his first office. Quoting Dr. Baker: "There I found a woman with three or four children waiting for my services. I extracted about a dozen deciduous teeth. The lady asked how much she owed me. This took me by surprise, for I had not given the matter of fees much consideration, so I told her 'seventy-five cents.' She paid me and I was then in the practice of dentistry.

"I practiced two years in Riverdale, Illinois. My office was on the second floor of a store building. It was not supplied with heat, electricity, or gas. The laboratory was equipped with a sink and a cold water faucet. A coal stove was used for heating, and an ordinary tin cuspidor had to be emptied frequently. I used a foot-powered dental engine; a gasoline-burning blowpipe, burner, and vulcanizer; and a foot-powered lathe. An oil lamp on the bracket table furnished light for evening work."

I could go on, if time would permit, describing how this man went from Demonstrator in Orthodontics to finally become Head of the Orthodontic Department of Northwestern University, where he established a graduate course in orthodontics. Besides establishing a practice and giving a great deal of time to Northwestern University Dental School, what did young Dr. Baker do in dental society work? The list of his activities in local, state, and later national association work should be reflected upon by every one here who ever hesitates about taking part in the running of a society. The amount of time that Charlie Baker has given and the work that he has done for the profession of dentistry and orthodontics are almost beyond comprehension, and I hereby confess that gathering the material for this presentation has had a very humbling effect upon me.

From 1905, when Dr. Baker became a member of the Chicago Dental Society, there was never a time when he was not active in the work of at least one dental or orthodontic society. That year he was appointed editor of the *Northwestern Dental Journal,* an alumni publication, and carried on as such for five years, until publication was discontinued.

In 1907 he was made Secretary-Treasurer of the Northwestern University Dental School Alumni Association, later becoming its President. In 1909 he gave up general practice and limited his work to orthodontics, but still had time, in 1914, to be a charter member of the Evanston Association of Dentists, which was organized principally to care for the dental needs of children in low-income families, and to work in the free dental dispensary.

That same year, 1914, he became a member of the American Association of Orthodontists and has attended every meeting in the forty years since that time. He is now Librarian of the A. A. O. and told me how happy he is to finally have the records of its proceedings complete from the first meeting in 1901 up to date.

In 1927 he became Secretary-Treasurer of the American Association of Orthodontists and, after serving in that capacity for four years, became its

President in 1932. That same year he was also President of the Chicago Dental Society. He was one of the organizers, in 1925, of the Chicago Association of Orthodontists, becoming its President in 1929.

In 1928 Dr. Baker was elected Fellow of the American College of Dentists, and the same year he became President of the Evanston Association of Dentists.

For six years, from 1936, he was Secretary of the American Board of Orthodontists, becoming its President in 1942. That same year he was President of the Central Section of the American Association of Orthodontists, holding that office for two years.

Dr. Baker is a past grand master and life member of Delta Sigma Delta Fraternity, and a recipient of the Omicron Kappa Upsilon key. In 1947 he received the Award of Merit from the Alumni Association of Northwestern University.

Since Dr. Baker's first paper in 1916 on "The Deciduous Molars and Their Relation to the Development of the Jaws" was read before the Dewey School of Orthodontics Alumni Society, hardly a year has gone by without some additional contribution being made in the form of papers, publications, or clinics given.

During the fifty years of his professional life, Dr. Baker has written about sixty papers, thirty of which have been published in dental journals;* participated in many formal and informal discussions of orthodontic subjects; presented many clinics; and served on about 200 committees in dental organizations.

In Charlie Baker we have the true exemplification of a man determined to reach a goal and, when that goal has been attained, ever after to show his love and appreciation for his profession and his fellow man by ably serving in every capacity in which it is possible for a man to serve.

And now, by virtue of the power vested in me by the American Board of Orthodontics, it is my greatest pleasure and honor to bestow upon you, Charles Reeder Baker, the Albert H. Ketcham Award for the year 1954.

RESPONSE BY CHARLES R. BAKER TO THE PRESENTATION OF THE ALBERT H. KETCHAM MEMORIAL AWARD

This is the proudest moment of my life. Having known Albert Ketcham as a dear friend for many years, respected him as a great orthodontist, and appreciated his many contributions to orthodontics, this memorial award, in his name, has a special meaning to me.

I am glad that I chose to be an orthodontist, and that I have had the happy privilege of being a member of this great organization for the past forty years. Our members are highly regarded for their professional attainments,

*A complete list of Dr. Baker's papers, published and unpublished, appears after his Response to the Presentation of the Albert H. Ketcham Memorial Award.

and there is always gracious cooperation and genuine friendship among us. Our annual sessions and the close association with the leaders in our special field have served as a real inspiration to me.

I am grateful to your representatives who selected me to receive the Award, which I humbly accept with sincere thanks and appreciation. I shall always strive to be worthy of your confidence in me.

PUBLISHED PAPERS BY CHARLES R. BAKER

1. An Idea Concerning the Development of the Jaws, D. Rev. **30**: 1136, 1916.
2. The Deciduous Molars and Their Relation to the Development of the Jaws, INT. J. ORTHODONTIA **3**: 253, 1917.
3. Dental Offices, Chicago Dent. Soc. Bull. **1**: 9, 1920.
4. A Consideration of the Exchange of Deciduous for Permanent Teeth, Nat. Dent. A. J. **7**: 753, 1920.
5. Report of Congenitally Missing Teeth and Supernumerary Teeth, INT. J. ORTHODONTIA **9**: 617, 1923.
6. Case Report, INT. J. ORTHODONTIA **9**: 280, 1923.
7. Reunion of Class of 1903, Northwestern University Dental School, Northwestern Dent. J. **14**: 51, 1922-1924.
8. The Care of Children's Teeth From the Viewpoint of an Orthodontist, J. Am. Dent. A. **10**: 296, 1923.
9. Similarity of Malocclusion in Families, INT. J. ORTHODONTIA **10**: 459, 1924.
10. The Importance of Radiography in Orthodontia, INT. J. ORTHODONTIA **10**: 566, 1924.
11. The Correct Time for Orthodontic Treatment, J. Am. Dent. A. **12**: 759, 1925.
12. Congenitally Missing Maxillary Lateral Incisors and Maxillary Deciduous Laterals and Canines Extracted, INT. J. ORTHODONTIA **12**: 849, 1926.
13. The Mershon Removable Lingual Appliance, Ill. S. Dental Soc. Trans., p. 143, 1926.
14. Technique of Taking Impression of a Molar Tooth for Which an Orthodontic Band Is to Be Made, First Int. Ortho. Congress Trans., p. 689, 1926.
15. Indications for the Treatment of Malocclusion, J. Am. Dent. A. **14**: 777, 1927.
16. Orthodontic Treatment of Deciduous Dentures, INT. J. ORTHODONTIA **14**: 142, 1928.
17. The Obligations of the General Practitioner in the Prevention and Interception of Malocclusion, Ohio State Den. Soc. J. **5**: 165, 1931, and Illinois Dent. J. **1**: 41, 1931-1932.
18. The President's Page, Chicago Dent. Soc. Bull., June 18, 1931.
19. President's Address, American Association of Orthodontists, INT. J. ORTHODONTIA **18**: 1251, 1932.
20. Time for Corrective Orthodontic Treatment, INT. J. ORTHODONTIA **19**: 1089, 1933.
21. Should the Undergraduate Dental Student Treat Orthodontic Cases? INT. J. ORTHODONTIA **20**: 1223, 1934.
22. The Conduct of an Orthodontic Practice, INT. J. ORTHODONTIA **21**: 115, 1935.
23. More About Treatment of the Deciduous Dentition, INT. J. ORTHODONTIA **22**: 543, 1936.
24. The Responsibilities Involved in the Treatment of Malocclusion, Texas Dent. J. **55**: 390, 1937.
25. Mail Order Orthodontics, J. Am. Dent. A. **27**: 408, 1940.
26. Presentation of the Albert H. Ketcham Memorial Award to Dr. Harry E. Kelsey, AM. J. ORTHODONTICS AND ORAL SURG. **28**: 465, 1942.
27. Report of the American Board of Orthodontics, AM. J. ORTHODONTICS AND ORAL SURG. **28**: 584, 1942.
28. The Development of the Occlusion of the Teeth, J. Am. Dent. A. **31**: 1662, 1944.
29. The Advisability of Orthodontic Treatment in Deciduous and Mixed Dentitions, Fort. Rev. Chicago D. Soc. **19**: 9, 1950.
30. The Selection of Cases for Treatment in the Deciduous Dentition, AM. J. ORTHODONTICS **39**: 273, 1953.

UNPUBLISHED PAPERS BY CHARLES R. BAKER

March 29, 1926. Conduct of an Orthodontic Practice. Chicago Association of Orthodontists.

Oct. 26, 1926. Treated Cases of Distoclusion With Open-Bite. Chicago Association of Orthodontists.

Nov. 29, 1926. Indications for Orthodontic Treatment. Chicago Association of Orthodontists.

Jan. 27, 1927. Indications for the Use of Various Types of Orthodontic Appliances for Corrective Treatment of Malocclusion. Chicago Dental Society.

May 3, 1927. Round Table Discussion: "What Is the Present Status of Laboratory-Made Orthodontic Appliances? American Association of Orthodontists.

March 1, 1928. Diagnosis of Malocclusion and Correct Time for Treatment, Tri-city Dental Study Club. (Davenport, Iowa.)

April 2, 1928. A Review of Current Orthodontic Literature. Chicago Association of Orthodontists.

Oct. 22, 1928. Factors Governing the Beginning of Treatment of Distoclusion Before the Eruption of the Permanent First Molars. Chicago Association of Orthodontists.

Feb. 27, 1929. Maintenance of Function of Deciduous Molars. Great Lakes Society of Orthodontists. (Detroit, Mich.)

May 7, 1930. The Obligations of the General Practitioner in the Prevention and Interception of Malocclusion. Iowa State Dental Society. (Des Moines, Iowa.)

Oct. 6, 1930. Prevention and Interception of Malocclusion. Joint meeting—Northeast Missouri District; McDonough-Fulton District, Illinois; Adams-Hancock District, Illinois; Southeastern Iowa District. (Keokuk, Iowa.)

Nov. 24, 1930. Submerged Deciduous and Permanent Teeth. Chicago Association of Orthodontists.

April 20, 1931. Prevention and Interception of Malocclusion. St. Louis Society of Dental Science.

Oct. 20, 1931. The Development of the Dental Arches. American Dental Assistants' Association. (Memphis, Tenn.)

Jan. 22, 1934. Distoclusion Case. Chicago Association of Orthodontists.

Dec. 7, 1934. What Plan Do You Follow in the Examination of a Case of Malocclusion? New York Centennial Meeting.

Sept. 14, 1937. General Talk on Orthodontics. Macon-Moultrie Counties Dental Society. (Decatur, Ill.)

May 22, 1939. Commercial Laboratory Orthodontics. Chicago Association of Orthodontists.

April 29, 1940. Case Report—Distoclusion. Chicago Association of Orthodontists.

Jan. 22, 1945. Orthodontic Treatment of the Deciduous Dentition. Chicago Association of Orthodontists.

Sept. 27, 1949. How Can Our Specialty Meet Its Responsibility in the Demand for Orthodontic Services for the Masses? Central Section, American Association of Orthodontists.

Oct. 24, 1949. A Brief History of the Chicago Association of Orthodontists. Chicago Association of Orthodontists.

March 31, 1952. Posttreatment Disappointments, The Care of Children's Teeth, Chicago Association of Orthodontists.

Editorial

SPECIALISTS IN DENTISTRY

A NEW look at dental specialists, presumably from the general practitioner's viewpoint, was spotlighted in an editorial that appeared in the April, 1954, issue of the *Fortnightly Review* (the official organ of the Chicago Dental Society, one of the larger local dental societies in America).

The editorial was plainly critical of the rapid influx of specialists in all departments of dentistry, and pointed up the trend of "jumping the gun" to specialization, notwithstanding the fact that the law in some states requires five years of practice before a dentist can become a specialist. It was also pointed out that "many graduates leave school and immediately limit their practice without experience in general dentistry."

The editor of the *Fortnightly Review,* Edward J. Sullivan, observed that the increase of "specialists is happening with such alarming proportions that the dental profession may soon find itself in the same fix the medical profession is in, wherein all the choice work is grabbed by the specialist, and as a specialty of medicine, dentistry now has many specialists within a specialty." The editor also contends that dental schools are putting too much emphasis on developing specialists in narrow fields instead of turning out well-rounded dentists versed in all branches of dentistry, and he claims that the situation presents a problem for the future that should not be ignored.

Getting into the orthodontic field, for example, the editor contends that students are "not trained in their undergraduate days to perform orthodontics—it is made a postgraduate course." The editorial implies that, instead of going into general practice for experience, "many students are being lured into a specialty in the hope of greater financial return and that the idea of better health service to the public is being forgotten." In fact, he cites a poll conducted among senior dental students, asking what specialty of dentistry they would prefer. A wide majority chose orthodontics because of presumed better financial returns plus cleaner work and no night hours.

The punch line came, however, when the editor wrote something about "the new graduate being led to believe that orthodontics has a *halo of pure gold* around it and that he (meaning the new graduate) does not have the brains to practice it." It was plainly meant to imply, at least, that the student is given the impression in his undergraduate work that orthodontics is superscientific and requires advanced graduate work to include this subject in practice.

The important thing, however, which every orthodontist of experience knows, but which the editor may or may not know (at least he did not say), is that actual success in the practice of orthodontics depends much on experience, common sense, and clinical practice over a period of years. It does not depend

any more on scintillating brilliance than does any other department of practice. Were this not true, many of us would have been unable to endure longer than the traditional "cooling off," better known as "relapse," period of practice.

Anyway, *Time Magazine* picked up the "halo of gold" and quoted it from the Chicago editorial, and from the impact of the *Time* quotation came a avalanche of clippings to your editor from both professional and lay sources. For the most part, the writers were saying, with raised eyebrows and inferentially, "Tell us more (if you know) about that 'halo of gold' blurb in *Time Magazine.*"

Here is what *Time* had to say about orthodontics: "Dentistry is in danger of becoming as overspecialized as medicine, complained the Chicago Dental Society, largely because a specialty and high fees have become synonymous. To senior dental students the most alluring specialty is *orthodontia,* which, they believe, 'has a halo of pure gold around it.' "

The intimation about the presumed "golden fleece" radiation of orthodontic practice is new to many of the old-timers who practiced at a time when the word *orthodontics* was thought by most people to refer to some kind of astronomical unknown. Anyway, orthodontics did make the science page of *Time Magazine* and, even if the editor did fail to call the subject by its correct name *(orthodontics,* not *orthodontia*),* it clearly attracted a lot of attention, comment, and good-natured banter all the way from New York and Chicago's Gold Coast to the Golden Gate of California.

It all goes to show that the lure of the fatted calf or the Horatio Alger theme is a sure-fire bid for free publicity.

That leads up to the fact that the Report of the Special Committee on Admissions for the American Association of Orthodontists was made in Chicago in May. No doubt this subject of membership qualifications ties in with the subject under discussion, because there seem to be divergent opinions as to what qualifies a specialist to be a specialist, and the Chicago editorial again points up this time-honored question, which has been raised many times in the past.

The new committee is recommending 1,500 hours, minimum, in a qualified university training course, and that would eliminate all trained in the traditional preceptorships. Many are reluctant to agree to this for a number of reasons, but the principal reason seems to be logical. Many say that some of the very best clinical orthodontists in America came up through preceptorships and that this is not the time to discard one of the best methods of specialization training ever found, that is, training under a good clinical practitioner, not without more re-examination at least.

So there is another paradox. Editor Sullivan says there are too many specialists and too many schools turning them out. At the same time there is the tumultuous clamor for more and more well-trained men. They are wanted for institutions and prepaid health insurance setups of various kinds, and the

*New Gould Medical Dictionary, Philadelphia, 1949, The Blakiston Company.

principal inspiration for the demand seems to be the contention that the common man is unable to pay orthodontic fees; hence that "halo of gold" observation that made *Time Magazine*.

Maybe Dr. Angle was right at the start of the century when he screened each and every student who expected to specialize in orthodontics. He wanted to know the source of the student's inspiration—whether he was most interested in becoming a good orthodontist or in financial gain. If the answer was the latter, the traditional two strikes were on the student and he was suspect from there on.

This discussion, then, will focus attention on the recommendations of the Committee on Admissions for the A. A. O., and will serve a good purpose. It will stimulate discussion on whether the requirements for admission to the A. A. O. should be limited to the academic type of education only, or include the preceptorship type of preparation which has been long accepted as specialized training.*

The best answer as to the best education for a specialist, no doubt, is that some of each type of training is far better than all academic or all preceptorship. The addition of short, practical, university-sponsored intensive courses, sponsored by name men whose clinical ability is unchallenged, has proved popular and of great value to orthodontic education. Such courses are in great demand by all orthodontists, previous basic education or condition of servitude notwithstanding. It helps the work-a-day job of correcting malocclusion and making it stay that way, which, after all, is the problem at hand.

It is to the credit of the orthodontic specialty that there are many engaged in the work who have, at great expense, taken every short postgraduate course that is available. That is ample evidence that, whatever orthodontic training specialists in orthodontics have enjoyed, they are constantly on the alert and in need of clinical help and experience.

The Chicago editor asked, in conclusion, "Now is the dog wagging the tail or is the tail wagging the dog?" He might have answered that question by saying that the tail wagging the dog never lasts long because the dog won't hold still.

H. C. P.

*An amendment to the constitution and by-laws of the A.A.O. will be voted on in San Francisco, which declares 1,500 hours of academic training necessary and preceptor training not accepted.

Reports

REPORT OF THE PRESIDENT OF THE AMERICAN BOARD OF ORTHODONTICS TO THE DIRECTORS OF THE AMERICAN ASSOCIATION OF ORTHODONTISTS

I AM unable at this time to give you the name of the 1955 recipient of the Ketcham Award Memorial Certificate. The Ketcham Award Committee does not meet until this afternoon and I shall report its conclusions at a later session of this group.

During the period of the Ketcham Award presentation at this meeting we shall read the names of those certified at the 1953 session of the American Board of Orthodontics.

The American Board of Orthodontics has been in official session from last Tuesday until yesterday. Actually, we had convened the day before and have passed judgment on 179 applicants in all categories. Thirty-three candidates have been certified.

Since we allow only Canadian orthodontists to have affiliate certification from the American Board of Orthodontics, we have judged our procedure to be discriminating. Therefore, the American Board of Orthodontics has decided to offer affiliate certificates to all who may be affiliate members of the American Association of Orthodontists and who, otherwise, meet the Board requirements. I now present four items for the consideration of the Budget Committee:

1. Since the Council on Dental Education of the American Dental Association is undertaking a program of evaluating various graduate and postgraduate courses given, it has requested the cooperation of a consultant from the various specialties. As far as orthodontics is concerned, the consultant requested was from the American Board of Orthodontics. The Council on Dental Education informed us that the traveling expenses and per diem expenses of the consultant are not provided for in its budget and suggested that the American Board of Orthodontics assume the expenses for this special consultant. Inasmuch as the American Board of Orthodontics is in no position to sustain such an expense, it would like to refer the matter to the directors of the American Association of Orthodontists for inclusion in the Association's budget.

2. The Advisory Board for Dental Specialties, which meets annually in connection with the American Dental Association meeting, provides for one or two delegates from our Specialty Board. Inasmuch as the service our delegate renders is more in behalf of the American Association of Orthodontists

Presented before the American Association of Orthodontists, Chicago, Illinois, May 16, 1954.

than the American Board of Orthodontics, we should like to refer the expenses of our delegate to the directors of the American Association of Orthodontists to consider for inclusion in its budget.

3. For the first time in many years the American Association of Orthodontists failed to include in its 1953-1954 budget an item of $500.00 to be made available to the American Board of Orthodontics if the Board requested it. Since our operating expenses for the 1953-1954 period exceeded our income by the amount of $1,649.70 we respectfully request that this item again be included in the budget of the American Association of Orthodontists for 1954 and 1955. Explanation for our year's operation at a loss rests in the fact that we returned $1500.00 in application fees to men ineligible by reason of last year's action of requiring men to be members of the American Association of Orthodontists for at least three years, instead of the one year previously requested. To partially take care of this deficit for the future, we have raised our application fees for certification from $100.00 to $150.00, effective immediately. The Board has given careful consideration to the effect of this increase on receipt of the number of new applications. We feel reasonably sure that the number will not be reduced as a result of this action.

4. Inasmuch as there is likelihood of charges being made for the rooms used for future meetings of the American Board of Orthodontics, and inasmuch as the Board is in no position to assume this expense, it suggests that future Local Arrangements Committees of the American Association of Orthodontists provide suitable meeting rooms for the transaction of American Board of Orthodontics business at annual sessions immediately preceding the annual meeting of the American Association of Orthodontists at the expense of the American Association of Orthodontists. We respectfully refer this matter to the directors for inclusion in the budget.

The Local Arrangements Committee for the present meeting of the American Association of Orthodontists asked us a year ago to provide an exhibit of case reports from last year's examination. We have done this. Twenty of the thirty-five diplomates certified last year were invited to participate. They have responded and there will be approximately 300 beautifully prepared cases on exhibit in Room 18. Since the exhibit was so favorably received in Dallas last year, we have every reason to believe it will be similarly received at the present meeting. Thinking there might be some possibility that we might be requested to again provide an exhibit for the 1955 meeting in San Francisco, we are prepared to respond in the event the 1955 Local Arrangements Committee makes such a request. You must appreciate that the preparation and transportation of all of this material by the men who will present it is enormous, but let me assure you that they are most happy to make this contribution for the future benefit of those who contemplate taking the examination.

We note with considerable interest the large proportion of those seeking certification by the American Board of Orthodontics who received their training on a postgraduate or graduate level. Because of this and the ever-expanding contacts between the Board and such agencies as the Council on Dental

Education, the Advisory Board for Dental Specialties, and the American Association of Dental Schools, we found it very helpful this past year to have a teacher among us as a director. This experience entered prominently into our deliberations on the selection of a new director. A further quality desired in the new director for this year would be his willingness and capability of assuming the very burdensome responsibility of secretary of our board. Bearing these things in mind, our choice of director for the term 1954-1961 is Dr. Wendell L. Wylie.

Respectfully submitted,

RAYMOND L. WEBSTER, President
The American Board of Orthodontics

In Memoriam

DAVID WILLARD FLINT
1875-1954

THE American Association of Orthodontists and the dental profession lost one of their honored members on July 25, 1954, with the death of D. Willard Flint of Pittsburgh, Pennsylvania.

Dr. Flint was born April 26, 1875, in Stouffville, Ontario, Canada, the son of John B. and Ruth Revis Flint.

He studied dentistry one year at the University of Michigan. Then, when his family moved to the United States, he transferred to Western University of Pittsburgh, graduating in 1898. He practiced dentistry in Pittsburgh until 1902, at which time he attended the Angle School of Orthodontia. Subsequently, he returned to Pittsburgh, where he limited his practice to orthodontics, and was the first to specialize in his chosen field in the state of Pennsylvania.

About ten years ago Dr. Flint retired and his two sons, who had been associated with him, were at hand.

In 1900, Dr. Flint married Effie B. White of Chatham, Ontario, sister of Dr. Oliver White. They had three children: Wilson R., Edwin G., and Marion F. Mrs. Flint died in 1929.

Dr. Flint served as president of the American Association of Orthodontists in 1918, having it incorporated in Alleghany County; the Odontological Society of Western Pennsylvania; and the Pittsburgh Academy of Dentistry. He was Professor of Orthodontics at the University of Pittsburgh from 1905 until 1910. He was a diplomate of the American Board of Orthodontists, a Fellow of the International College of Dentists, and a member of the American Association of Orthodontists, Omicron Kappa Upsilon fraternity, and the Delta Sigma Delta fraternity.

He was past president of the Pittsburgh Kiwanis Club, former director of the Pittsburgh Rotary Club, a member of Beta Lodge No. 647 F. and A. M., the Consistory and the Shrine, and the Edgewood Country Club.

Dr. Flint was a very active Methodist layman, in addition to having taught a Sunday School Class for more than fifty years. At the time of his death he was a member of the Calvary Methodist Church of Lake Worth, Florida, which was his winter home. Death occurred at his summer home in Canada, very suddenly while he was in the best of health. Burial was in Pittsburgh, Pennsylvania.

Dr. Flint was an excellent orthodontist, a thoroughly good man, and highly deserving of the esteem in which he was held by all who knew him. He had a host of good friends and his influence was directly or indirectly responsible for many boys' entering dentistry.

His energy was of such a character that he shared his every virtue with all those with whom he came in contact. His life exemplifies "that what we have done for ourselves alone dies with us, but what we have done for others and for the world remains and is immortal."

Dr. Flint was a fond husband and father. He is survived by Adelaide W. Broomall of Lake Worth, Florida, whom he married in 1931; two sons, Dr. Wilson R. Flint and Dr. Edwin G. Flint both of Pittsburgh; a daughter, Mrs. Marion F. Gordon; two step-daughters, Mrs. Richard Horn and Mrs. Franz Metzger; six grandchildren; and two great-grandchildren.

Memory of him will long survive.

Henry D. Cossitt.

CHARLES RUSH STRAUB
1903-1954

AFTER a long illness, Dr. Charles Rush Straub died at Lakewood (Ohio) Hospital on May 26, 1954. He was born in Boswell, Pennsylvania, on Sept. 6, 1903. Early in life his family moved to Lakewood, Ohio, where he made his home also.

After spending two years at Adelbert College of Western Reserve University, he entered the School of Dentistry where he received his degree of Doctor of Dental Surgery in June, 1928. In the year 1938 he returned to his alma mater as an instructor of orthodontics and later was promoted to assistant professor of orthodontics. Dr. Straub at first practiced general dentistry, but for the past twelve years devoted his time to orthodontics exclusively.

He was past president of the Cleveland Society of Orthodontists and a member of the following organizations: Great Lakes Society of Orthodontists, American Association of Orthodontists, Cleveland and Ohio State Dental Societies, American Dental Association, Psi Omega Fraternity, and Omicron Kappa Upsilon Honorary Dental Fraternity. He was also a lifelong member of Lakewood Methodist Church.

Dr. Straub was married to Miss Leona F. Denne in 1931. He leaves his widow; two daughters, Nancy E. and Verna R.; a son, Charles D.; his father; and sister.

FRANK R. BRISTOL
1890—1953

ON JUNE 7, 1953, Frank R. Bristol died after several months' illness. Born in Troy, New York, he attended Troy Academy and received his D.D.S. degree from the Baltimore College of Dental Surgery in 1914. Soon, after being refused a commission because he was underweight, he enlisted in

the Army, and after eighteen months' service he was commissioned. Following the war, he maintained his Reserve status and tried to enlist again in World War II, but was refused for physical reasons.

In 1919 Dr. Bristol returned to Rochester and was associated with the Eastman Dental Dispensary; later he spent part of his time with Dr. Schlenker studying orthodontics. In 1922 he opened his own office for the practice of orthodontics and served part-time at the Baden Street Clinic.

Dr. Bristol married Margaret Henry, a graduate of the Rochester General Hospital School of Nursing, in 1924. He was a Master Mason, a member of Grace Methodist Church and the American Legion, and belonged to the Rochester Dental Society, Seventh District Society of the State of New York, the American Association of Orthodontists, and the Great Lakes Society of Orthodontists.

Department of Orthodontic Abstracts and Reviews

Edited by
DR. J. A. SALZMANN, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Variations in Human Body Build; A Somatometric and X-Ray Cephalometric Investigation on Scandinavian Adults: By Bengt Lindegard. From the Department of Anatomy, University of Lund (Professor Carl-Herman Hjortsjo), and from the Department of Orthodontics, Royal Dental College, Copenhagen (Professor Arne Bjork). Acta Psychiat. et neurol.; supplementum 86. Published by Ejnar Munksgaard, Copenhagen, 1953.

While the relationship of body build to personality pattern, physiologic characteristics, and susceptibility to disease was recognized by Hippocrates about 400 B.C., it was not until the twentieth century that this study began to take scientific form. Sheldon and his co-workers in 1940 elaborated Kretchmer's observations and worked out a method of somatotyping the three components of body build (endomorphy, mesomorphy, and ectomorphy) according to a seven-point scale in which 4 indicates the mid-point.

Lindegard used mainly the material originally collected by Björk, whose work is well known and highly regarded in the United States. To the foregoing study of males the author added data on a group of females.

Somatic measurements were made in accordance with the technique described by Martin in 1928. Ernest A. Hooton of Harvard University rated the somatotypes on the basis of photographs taken by the method of Dupertius and Tanner (1950). Measurements on the x-ray films of the skull were made essentially after the method of Björk.

Although the growth pattern of the body build is dictated mainly by the genes, it is dependent to a great extent also on environmental factors, such as nutrition and muscular activity.

Chapters in this study are devoted to the nature of body build variations, variations in skeletal build, variations in the amount of soft tissue, sex differences in body build, and the body build as a whole. In this review we shall concern ourselves mainly with the cranial and facial parts of the study. Attention is called to Kretschmer's observation that the shape of the body and that of the face sometimes develop in opposite directions. Thus, a lean (leptosomatic) body build can be found with a corpulent (pyknic) face.

Lindegard found head length to be significantly correlated with all the other head dimensions recorded except with bigonial breadth. Bi-auricular breadth showed a correlation with most of the dimensions of the head but not with head height or face height. Additional measurements described found no distinct association between the shape of the face and the shape of the general body build.

The lengths of the anterior part of the cranial base (nasion to sella) and the posterior part (sella to basion) were found to have a significant correlation, with the posterior part showing an inverse correlation to the n-s-ba angle. No significant correlation was found between cranial base length and length of

the long bones of the body. However, total length of the mandible was found to be significantly correlated with the lengths of the radius and tibia (length factor). This, it is pointed out, is in agreement the findings of a number of American workers who found growth in length of the mandible to be due partly to growth at the condylar portion of the mandible. A significant correlation was found also between mandibular base length and the nasion-sella distance (sturdiness factor). While no significant correlation was found between the length factor and the length of the cranial base, a large length factor was found to be usually associated with a flat cranial base.

The length and height of the upper face (the area between nasion and sella above and subspinale and pterygomaxillare below in this study) was found to be correlated to the body of the maxilla as a whole. A long maxillary body was found to be associated with a high degree of basal maxillary prognathism, a large maxillary protrusion, a large posterior upper face height, and probably also a large anterior face height.

While maxillary protrusion is negatively associated with anterior face height it is positively correlated with posterior height. Large anterior and posterior face heights were found, as a rule, in association with a large body length factor.

Mandibular length, from condylion to menton, was not found to be correlated to the mandibular base angle, although the horizontal and vertical lengths of the mandible were significantly correlated with the mandibular base angle. Furthermore, the mandibular base angle was found not to be correlated with the size or shape of the cranial base or the upper face. However, mandibular base length was found by Lindegard to be significantly correlated with the sagittal and vertical extensions of the upper face.

The degree of alveolar prognathism of the upper jaw was shown to be proportional to that of the lower jaw. In pronounced alveolar prognathism the incisor axis inclination is, as a rule, small. A long mandibular base was seen to be associated with a strong maxillary and weak mandibular alveolar prognathism and with large anterior and posterior lower face heights.

A large posterior total face height in relation to anterior height is, as a rule, associated with a pronounced bend in the cranial base, pronounced maxillary protrusion, and pronounced curvature of the mandibular base.

Size of the freeway space was found by the author to be correlated with sagittal jaw relation and with the vertical extension of the total face. A large freeway space is usually associated with a small anterior and a large posterior total face height. The freeway space is most strongly correlated with the shape of the lower face. However, there was no correlation found between the freeway space and the vertical extension of the upper face. The freeway space is positively correlated with the mandibular base angle, but not with the length of the mandibular base itself.

Lindegard's work verifies Björk's findings to the effect that there is a positive relationship between the cranial base angle and prognathism. The vertical extension of the face in this study was found to be inversely proportional to the sagittal extension. This is in accord with Björk's finding that the greater the degree of prognathism, the smaller the facial height. However, Lindegard found no correlation between the degree of the cranial base angle and the height of the face from nasion to gnathion. To the contrary, the more pronounced the cranial base angle, the greater the posterior face height.

The length of the cranial base from nasion to sella was found to be directly related to maxillary protrusions. However, prognathism does not express the length of the face but only the proportion between anterior cranial base length and facial length.

Lindegard summarizes his findings as follows:

"An individual with a large length factor and an average-sized sturdiness factor is characterised by long extremities, a broad, deep and long trunk skeleton, flattened cranial base form, high upper face and long mandible (as measured by the chin-condyle distance).

"An individual with a large sturdiness factor, but average-sized length factor, shows the following features: long hands and long feet, broad chest, large bi-acromial and bi-iliac breadths, large brain case, large cranial base length and large face length."

This book deserves the careful study of all who recognize the importance of the growth and development pattern of the individual in relation to the attempts to influence and change growth in the treatment of dentofacial abnormalities and malocclusion of the teeth. The author is to be congratulated on this important investigation.

J. A. S.

News and Notes

1955 Prize Essay Contest, American Association of Orthodontists

Eligibility.—Any member of the American Association of Orthodontists and any person affiliated with a recognized institution in the field of dentistry as a teacher, researcher, undergraduate, or graduate student shall be eligible to enter the competition.

Character of Essay.—Each essay submitted must represent an original investigation and contain some new significant material of value to the art of science of orthodontics.

Prize.—A cash prize of $500.00 is offered for the essay judged to be the winner. The committee, however, reserves the right to omit the award if, in its judgment, none of the entries is considered to be worthy. Honorable mention will be awarded to those authors taking second and third places. The first three papers will become the property of the American Association of Orthodontists and will be published. All other essays will be returned.

Specifications.—All essays must be in English, typewritten on 8½ by 11 inch white paper, double spaced with at least 1 inch margins. Each sheet must be numbered and bound or assembled with paper fasteners in a "brief cover" so that they may be handled easily. Three complete copies of each essay, including all illustrations, tables, and bibliography must be submitted. The name and address of the author must not appear in the essay. For purpose of identification, the author's name, together with a brief biographical sketch which sets forth his or her dental and/or orthodontic training, present activity, and status (practitioner, teacher, student, research worker, etc.) should be typed on a seperate sheet of paper and enclosed in a sealed envelope. The envelope should carry the title of the essay.

Presentation.—The author of the winning essay will be invited to present it at the meeting of the American Association of Orthodontists to be held at the Fairmont Hotel, San Francisco, California, the week of May 9, 1955.

Judges.—The entries will be judged by the Research Committee of the American Association of Orthodontists.

Final Submission Date.—No essay will be considered for this competition unless received in triplicate at the following address on or before Feb. 15, 1955: Dr. Alton W. Moore, Medical Dental Building, Seattle, Washington.

J. A. Salzmann, Chairman, Research Committee
American Association of Orthodontists
654 Madison Ave.
New York 21, N. Y.

American Association of Orthodontists, 1955 Research Section Meeting

Continuing the policy of recent years, the program will consist of a series of ten-minute research reports which may be presented orally or read by title only. All persons engaged in research are urged to participate in this program which will be held Wednesday afternoon, May 11, 1955, in the Fairmont Hotel, San Francisco, California.

Each participant is asked to prepare a 250-word abstract for publication in the AMERICAN JOURNAL OF ORTHODONTICS. Abstract for publication and the ten-minute oral presentation at the meeting should be carefully prepared to present an adequate description of the import of your investigation.

Forms for use in submitting the title and 250-word abstract of your research will be sent to each dental school orthodontic department and to any individual requesting one. Please send your title and abstract as early as possible, but not later than March 10, 1955, to Dr. Thomas D. Speidel, University of Minnesota, School of Dentistry, Minneapolis 14, Minnesota.

J. A. Salzmann, Chairman
Research Committee
American Association of Orthodontists
654 Madison Ave.
New York 21, N. Y.

American Association of Orthodontists 51st Annual Session

The Mark Hopkins Hotel, San Francisco, where rooms have been set aside for the 1955 annual meeting of the American Association of Orthodontists, May 8 to 12, 1955.

Application for Hotel Accommodations

A Housing Bureau has been organized to facilitate the handling of room reservations for the all-important convention, which will be held May 8 to 12, 1955, in San Francisco, California. Since all requests for rooms will be handled in chronological order, it is recommended that you send in your application as soon as possible.

The Fairmont Hotel will be headquarters, and rooms have been set aside at the following hotels:

	Single	*Double*	*Twin Bed Room*	*Parlor Suite*
Fairmont Hotel	$10.50-$16.00	$13.50-$19.00	$13.50-$19.00	$28.00-$56.00
Huntington Hotel	8.00- 12.50	8.00- 15.00	8.00- 15.00	15.00- 30.00
Mark Hopkins Hotel	10.00- 14.00	13.00- 20.00	13.00- 20.00	25.00- 55.00

The hotels listed on page 803 are situated on Nob Hill. Other Class A hotels under reservation are:

Bellevue Hotel	$6.00-$ 8.00	$ 8.00-$10.00	$ 9.00-$11.00	$16.00-$22.00
Clift Hotel	8.00- 20.00	10.00- 15.00	11.00- 20.00	18.00- 50.00
Sir Francis Drake	9.50- 13.50	11.50- 15.50	13.00- 19.50	27.00- 55.00

All requests should be accompanied by a deposit check of $5.00 per person, made payable to the American Association of Orthodontists Housing Bureau. Hotels cancel unclaimed reservations by 6 P.M. Therefore, a deposit is requested by the hotels to ensure your reservation being held on your arrival day, whatever the hour. Your deposit will be credited to your account. Please do not send cash.

Please complete the application below. All reservations will be confirmed if request is received not later than April 29, 1955.

MAIL TO: AMERICAN ASSOCIATION OF ORTHODONTISTS HOUSING BUREAU
ROOM 300, 61 GROVE ST.
SAN FRANCISCO 2, CALIF.

Please make reservations noted below:

First Choice _____Hotel Arriving May _____at_____A.M._____P.M.

Second Choice _____Hotel Departing May _____.

Third Choice _____Hotel

_____Single room @ $_____ to $_____ per room

_____Double Bed Rm. @ $_____ to $_____ per room

_____Twin Bed Room @ $_____ to $_____ per room

_____Parlor, Bedroom suite @ $_____ to $_____ per suite

NAMES OF ALL OCCUPANTS:

_____

_____

_____

_____

Check for $_____(Payable to AMERICAN ASSOCIATION OF ORTHODONTISTS HOUSING BUREAU) is enclosed.

Signed _____

Address _____

City _____ State _____

To facilitate mailing, please enclose a stamped, self-addressed envelope

---

American Board of Orthodontics
A. B. O. Theses Available for Reading on Constituent Society Programs

Reading of A.B.O. theses by diplomates before constituent societies has been disallowed for the past several years. This stand was taken because of serious abuses encountered.

Year after year desire for usage of these theses among constituent societies had increased to the point where the American Board of Orthodontics undertook a serious

attempt to make some of them available, while at the same time protecting our profession by enactment of rigid controls aimed at prohibiting the abuses.

In 1953 the Board created a pool of theses available for reading before constituent societies, should they be desired. At the present time, twenty-five theses are in this pool, from the 1953 and 1954 examinations.

Rules for using these theses are as follows:

1. Permission for inclusion on programs must be requested by the secretary of the constituent society in writing and filed with the secretary of the American Board of Orthodontics.
2. The constituent society must not offer the paper for publication in any journal without express written permission from the Board.
3. Should permission be given for publication, no reprints will be permitted under any circumstances.
4. The author of the thesis is required to announce that the paper was part of his A.B.O. requirements; and that the Board has granted permission for the presentation, and that such permission does not necessarily imply that the Board is in agreement with the concepts expressed in the thesis.

The following theses are available from the 1953 Pool:

Author	Title
Robert E. Baker	The Tongue and Dental Function
Allen C. Brader	A Cephalometric X-ray Appraisal of Morphological Variations in Cranial Base and Associated Pharyngeal Structures: Implications in Cleft Palate Therapy
Donald A. Closson	Occipital Anchorage: The Changing Concept
David L. England	A Study of the Resilience of Wire Forms Commonly Employed in Orthodontic Procedures
Eugene H. Farber	A Rational Approach to the Treatment of the Mixed Dentition
Glen W. Foor	Standardized Technic for Temporomandibular Joint Radiography
Barnett Frank	A Rationale for Closer Cooperation Between the Orthodontist and the Speech and Hearing Therapist
John S. Rathbone	Appraisal of Speech Defects in Dental Anomalies
Kenneth M. Walley	A Survey of Attitudes in Respect to a Malocclusion and Its Treatment
Solon P. Crain	The Comprehension of Diagnostic Differentiation of Class III Cases for the Instigation of Treatment Therapeutics
Earl R. Crane	Mixed Dentition Thumb-Sucking
Robert M. Cole	The Relative Importance of the Orthodontist in the Cleft Palate Program
Robert C. Germond	A Survey of Current Practice Procedures
M. M. Gershater	A Study of the Orthodontic Problem of 465 Emotionally Disturbed Children
Louis Kreshtool	Is There a Relation Between Malocclusion of the Teeth and Deviations in Speech?
Harold E. Leslie	A New Improved Method of Treatment of Impacted or Unerupted Teeth
Joseph Luban	Speech and the Cleft Palate Patient
Leo B. Lundergan	Preventive Dentistry and Preventive Orthodontics Through Public Dental Health Education
William S. Parker	Death, and the Orthodontist
Walter G. Spengeman	The Dilemma of Undergraduate Orthodontic Education and Its Effect

Author	Title
Morris M. Stoner	A Photometric Analysis of the Facial Profile. A Method of Assessing Facial Change Induced by Orthodontic Treatment
H. K. Terry	Centric Relation Applied to Orthodontics
Harold E. Thompson	Speculations on the Potentialities of Connective Tissue Fibers
R. L. Whitney	On Orthodontic Concept
Guy A. Woods, Jr.	Toothbrushing Procedure for Orthodontic Patients

C. Edward Martinek, D.D.S., Secretary
American Board of Orthodontics
661 Fisher Bldg., Detroit 2, Mich.

American Board of Orthodontics

The next meeting of The American Board of Orthodontics will be held at the Fairmont Hotel in San Francisco, California, May 3 through May 7, 1955. Orthodontists who desire to be certified by the Board may obtain application blanks from the secretary, Dr. C. Edward Martinek, 661 Fisher Bldg., Detroit 2, Michigan.

Applications for acceptance at the San Francisco meeting, leading to stipulation of examination requirement for the following year, must be filed before March 1, 1955. To be eligible, an applicant must have been an active member of the American Association of Orthodontists for at least three years.

Great Lakes Society of Orthodontists

The Great Lakes Society of Orthodontists will hold its Silver Anniversary Meeting Oct. 31 to Nov. 3, 1954, at the Statler Hotel in Detroit, Michigan. The following is a tentative program of the meeting.

Monday Morning

8:00 Registration and Exhibits.
9:00 Business Session.
President's Address, Reports of Committees, etc.
10:00 Wendell L. Wylie, University of California.
Trends in Orthodontic Thinking.
11:00 Edward Cheney, Lansing, Michigan.
Tentative Title: Objectives and Responsibilities of Orthodontists.
12:00 Silver Anniversary Luncheon.

Monday Afternoon

2:00 Anders Lundstrom, Royal School of Dentistry, Stockholm, Sweden, Doctor of Odontology, Professor of Orthodontics at the Royal School of Dentistry, Stockholm.
The Importance of Genetic and Nongenetic Factors to the Profile of the Facial Skeleton Studied in 100 Pairs of Twins.
3:00 Richard E. Barnes, Cleveland, Ohio.
Molar Crowns and Anterior Bite Planes.
4:00 Russell E. Huber, Dayton, Ohio.
Orthodontics and Cleft Palate Rehabilitation.

Monday Evening

6:00 President's Reception.
7:00 President's Banquet.

Tuesday Morning

8:00 Exhibits.
9:00 Business Session.
10:00 Wendell L. Wylie, University of California.
Growth, Esthetics, and Function in Orthodontic Therapy.
11:00 Howard Strange, Chicago, Illinois.
Title to be announced.

Tuesday Afternoon

12:30 Past Presidents' Luncheon.
2:00 C. W. Carey, Palo Alto, California.
Diagnosis and Case Analysis.
3:00 Harvey Jenkins, Toronto, Ontario.
Cephalometric Evaluations of Significance in Various Forms of Malocclusion.
4:00 Paul V. Ponitz, Battle Creek, Michigan.
Different Treatments for Similar Cases.

Tuesday Evening

7:00 Table Clinics.

Wednesday Morning

8:00 Exhibits.
9:00 Business Session.
10:00 Earl Shepard, St. Louis, Missouri.
Probable title: The Application of the Twin Arch Mechanism in the Treatment of Malocclusion.
11:00 C. W. Carey, Palo Alto, California.
A Laminated Arch Technique Designed to Take Advantage of Light Ribbon-like Arches Used in Apposition for Strength, Long-Range Activity, and Tissue Toleration; Used Especially in Extraction Cases in the Space-Closing Operation.
12:00 Adjournment.

Northeastern Society of Orthodontists

The Northeastern (formerly New York) Society of Orthodontists will hold its fall meeting Oct. 25 and 26, 1954, at the Hotel Statler in Buffalo, New York. The following is a tentative program of the meeting.

Monday Morning

9:30 To be announced.
10:30 Extraoral Appliances—Facts and Fallacies. T. M. Graber, Chicago, Illinois.
11:15 to 11:45. Human Head and Figures. Wilfred I. Duphiney, Providence, Rhode Island.
11:45 to 12:30. On the Relative Importance of Genetic and Nongenetic Factors to the Profile of the Facial Skeleton (based on twin investigation). Anders Lundstrom, Stockholm, Sweden.

Monday Afternoon

12:30. Luncheon.
2:00 to 2:45. Barnett Frank, Rochester, New York.
2:45 to 3:30. Problems and Limitations of a Cephalometric Analysis. T. M. Graber, Chicago, Illinois.

3:30 to 4:00. To be announced.

4:00 to 4:30. To be announced.

4:30. Executive Session.

Tuesday Morning

9:30 to 10:15. An Analysis of Changes in the Dentofacial Skeleton Following Orthodontic Treatment. Coenraad F. Moorrees, Boston, Massachusetts.

10:15 to 11:15. The Correlation Between Size of Teeth and Relative Arch Spacing. Anders Lundstrom, Stockholm, Sweden.

11:15 to 11:45. Diagnosis and Treatment—Occipital Anchorage. Walter Mosmann, Hackensack, New Jersey.

11:45 to 12:30. To be announced.

Tuesday Afternoon

12:30. Luncheon.

1:30 to 2:00. Executive Session.

2:00. CLINICS.

1. The Rehabilitation of the Cleft Palate Child. J. Sutton Regan Cleft Palate Foundation, Buffalo, New York.
2. Table Clinic. William G. Houghton, Watertown, New York.
3. Clinic Supplementing Paper by C. F. A. Moorrees. Peter Kai-jen Yen and Marie Louise Harin.
4. Clinic Supplementing Paper. Walter Mosmann.
5. Clinic Supplementing Paper. Barnett Frank.

Southern Society of Orthodontists

The Southern Society of Orthodontists will hold its next annual meeting in Washington, D. C., Oct. 31 through Nov. 3, 1954, at the Mayflower Hotel.

The August, 1954, Convention Issue of the *News Letter* of the Southern Society of Orthodontists has just been opened on the desk of the editor. The masthead features the names of Fairbank, Jarrett, Curtis, Jaynes, Higley, Brandhorst, Sved, and Thompson, and points out that members are assuming an important role in connection with the fall meeting in Washington, D. C. Also it lists the guests who have been invited to appear on the program.

President Fairbank reminds all that it is his wish that every effort be made to attend the 1954 meeting.

Southwestern Society of Orthodontists

The Southwestern Society of Orthodontists will hold its next meeting Oct. 10 through Oct. 13, 1954, at the Skirvin Hotel, Oklahoma City, Oklahoma.

Third Public Health Workshop on Dental Programs in Industry

The Third Public Health Workshop on Dental Programs in Industry is to be held at the Hotel Statler in New York City, on Friday, Jan. 21, 1955.

Association of Military Surgeons of the United States

Suite 718 New Medical Building
1726 Eye St., N. W., Washington 6, D. C.
NAtional 8-2206

The Sixty-first Annual Convention of the Association of Military Surgeons of the United States will be held Nov. 29 through Dec. 1, 1954, at the Hotel Statler, Washington, D. C.

The program will cover a wide range of professional and scientific subjects which should be of interest to all those engaged in military medicine and the federal health services. The latest advances in medical and allied sciences will be shown in a large variety of technical exhibits and films.

Temple University

Temple University of Philadelphia, Pennsylvania, has announced a two-week course in orthodontics for practicing orthodontists under R. H. W. Strang, D.D.S., Jan. 23, 1955, to Feb. 5, 1955.

Notes of Interest

Frank P. Gilley, D.D.S., M.S.D., announces his return from active duty with the United States Navy and the resumption of his practice of orthodontics at Suite 205, 31 Central St., Bangor, Maine.

S. James Krygier announces the removal of his offices to 1200 Delaware Ave., Wilmington, Delaware, practice limited to orthodontics.

Charles H. Meinhold, D.D.S., M.S., announces his return from service in the Dental Corps of the United States Navy and the resumption of his practice of orthodontics at 1221 Temple Bldg., Rochester, New York.

John W. Ross, D.D.S., announces that after Aug. 1, 1954, his office will be located at 1625 Spruce St., Philadelphia, Pennsylvania, practice limited to orthodontics.

James L. Wilson announces the opening of his offices for the exclusive practice of orthodontics at 1500 E. Broward Blvd., Fort Lauderdale, Florida, and 620 E. Atlantic Ave., Delray Beach, Florida.

Dr. Howard Yost announces the association of Dr. R. H. Donley, 803 West Division St., Grand Island, Neb., practice limited to orthodontics.

OFFICERS OF ORTHODONTIC SOCIETIES

The AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS is composed of a representative of each one of the component societies of the American Association of Orthodontists.

American Association of Orthodontists

President, Frederick T. West - - - - - - - - 760 Market St., San Francisco, Calif.
President-Elect, Philip E. Adams - - - - - - - 106 Marlborough St., Boston, Mass.
Vice-President, George H. Herbert - - - - - - - - 7002 Pershing Ave., St. Louis, Mo.
Secretary-Treasurer, Franklin A. Squires - - - - - Medical Centre, White Plains, N. Y.

Central Section of the American Association of Orthodontists

President, Earl E. Shepard - - - - - - - - - - 8230 Forsyth Blvd., St. Louis, Mo.
President-Elect, Howard Yost - - - - - - - - - - - - - - - - Grand Island, Neb.
Secretary-Treasurer, Frederick B. Lehman - - - - - - - 1126 Merchants Bank Bldg., Cedar Rapids, Iowa

Great Lakes Society of Orthodontists

President, Louis Braun - - - - - - - - - 1601 David Whitney Bldg., Detroit, Mich.
Vice-President, Richard C. Beatty - - - - - - - - - Hanna Bldg., Cleveland, Ohio
Secretary, Hunter I. Miller - - - - - - - 1416 Mott Foundation Bldg., Flint, Mich.
Treasurer, George S. Harris - - - - - - - - 18520 Grand River Ave., Detroit, Mich.

Middle Atlantic Society of Orthodontists

President, Raymond C. Sheridan - - - - - 59 S. Orange Ave., South Orange, N. J.
Secretary-Treasurer, Gerard A. Devlin - - - - - - - - 49 Bleeker St., Newark, N. J.

Northeastern Society of Orthodontists

President, Philip E. Adams - - - - - - - - - 170 Marlborough St., Boston, Mass.
Secretary-Treasurer, Wilbur J. Prezzano - - - - - Medical Centre, White Plains, N. Y.

Pacific Coast Society of Orthodontists

President, Arnold E. Stoller - - - - - - - - - Medical Dental Bldg., Seattle, Wash.
Secretary-Treasurer, Raymond M. Curtner - - - - - 450 Sutter St., San Francisco, Calif.

Rocky Mountain Society of Orthodontists

President, Don V. Benkendorf - - - - - - - - - Metropolitan Bldg., Denver, Colo.
Vice-President, Walter K. Appel - - - - - - - - 4018 Moore Ave., Cheyenne, Wyo.
Secretary-Treasurer, Curtis L. Benight - - - - - - 1001 Republic Bldg., Denver, Colo.

Southern Society of Orthodontists

President, Leigh C. Fairbank - - - - - - - - 1726 Eye St., N.W., Washington, D. C.
Secretary-Treasurer, M. D. Edwards - - - - - - - 132 Adams Ave., Montgomery, Ala.

Southwestern Society of Orthodontists

President, Marion A. Flesher - - - - - - Medical Arts Bldg., Oklahoma City, Okla.
President-Elect, William N. Pugh - - - - - - Union Natl. Bank Bldg., Wichita, Kan.
Vice-President, Ott Voight - - - - - - - - - - Medical Arts Bldg., Houston, Texas
Secretary-Treasurer, Fred A. Boyd - - - - - - - 1502 North Third St., Abilene, Texas

American Board of Orthodontics

President, Raymond L. Webster - - - - - - - - 133 Waterman St., Providence, R. I.
Vice-President, Ernest L. Johnson - - - - - - - - 450 Sutter St., San Francisco, Calif.
Secretary, G. Edward Martinek - - - - - - - - - 661 Fisher Bldg., Detroit 2, Mich.
Treasurer, Lowrie J. Porter - - - - - - - - - 41 East 57th St., New York, N. Y.
Director, William R. Humphrey - - - - - - - - - - - Republic Bldg., Denver, Colo.
Director, L. Bodine Higley - - - - - - University of North Carolina, Chapel Hill, N. C.
Director, Wendell L. Wylie - - - - - University of California, San Francisco, Calif.